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PROCEEDINGS

OF THE

ROYAL PHYSICAL SOCIETY

OF

EDINBURGH.

1854-1858.



VOL. I.

EDINBURGH:

PRINTED FOR THE SOCIETY BY NEILL AND COMPANY.

MDCCCLVIII.

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PROCEEDINGS
OF THE
ROYAL PHYSICAL SOCIETY.

EIGHTY-FOURTH SESSION, 1854-55.

Wednesday, November 22, 1854.—HUGH MILLER, Esq., President, in the Chair.

The following Donations to the Library were presented, and thanks voted to their respective donors :—

1. Proceedings of the Royal Society of London, Parts 1 and 2 of Vol. VII. From the Society.—2. Anatomical and Physiological Observations. By John Struthers, M.D. From the Author.—3. On the Occurrence of Cinchonaceous Glands in Galiaceæ. By George Lawson, F.B.S.E. From the Author.

I. HUGH MILLER, Esq., the retiring President, delivered an opening address on “*The Fossiliferous Deposits of Scotland.*” (This has been published as a separate pamphlet.)

Professor Fleming moved a vote of thanks to Mr Miller, which was unanimously agreed to, for the able and beautiful exposition of the present state of our knowledge of the geology of Scotland they had just heard, which he trusted they would be favoured with in a more permanent form. The Professor also alluded to the great loss the Society, and science in general, had sustained in the death of Professor Edward Forbes.

II. *On a curious habit stated to have been observed in one of the Wood-peckers in California.* By ANDREW MURRAY, Esq.

In this communication, Mr Murray stated he had received information on the habits of one of the Californian woodpeckers, which appeared to him both sufficiently new and interesting to be worthy of being made generally known to naturalists ; and although the information is imperfect, and may possibly turn out to be incorrect, he was bold enough to communicate it to the Society. The statement is, that a particular wood-pecker in California lays up a store of acorns in autumn for its spring consumption, and does so by hammering out small holes in the bark of

trees, into each of which it places an acorn. His informant was his brother, Mr William Murray, whose botanical tastes may be probably known to some of the members of the Society. He resides at San Francisco ; but when home on a visit last year, he mentioned the habit of the wood-pecker which had just been related. Shortly after his return to California, he received from him the piece of bored bark, which he exhibited to the Society, and at the same time communicated the following information which he had picked up. He says,—“ I was talking to Simson the other day about the curious custom the woodpeckers here have of boring holes in the bark and storing them with acorns, when I mentioned that I had told you of it, and that you had refused to credit the fact, not of the acorns being there, but of their being put there by woodpeckers, because I was unable to say I had *seen* them put there. ‘ Well,’ said he, ‘ you can tell him that I’ve seen them. I have seen them bore the holes, put in the acorns, and hammer them well in, and I’ve seen them take them out again in spring ;’ and he went on to tell me, that, on one occasion, in the time of the great flood (some years ago), he had witnessed an amusing scene among them. His party were camped on a kind of island that had been left dry, and having nothing better to do, watched the operations of these birds. There were six or eight of them at work on a tree, in which there was a squirrel, who had made his house in a hollow at the root of a branch. The squirrel would pop out his head and look at them, and the moment the coast was clear, he would run out and scratch away at these things, and tear away the bark ; and when the birds would see him, they would all attack him, and he would run like lightning down the tree, and up the other side, and into his hole again, and then peep out and watch another chance to do the same, evidently having great fun. This continued for about three days, till at last one of the party knocked the squirrel’s head off with a rifle-ball, and rid them of their persecutor.” In a subsequent letter, his brother gives the following additional information. He says—“ Newland, a Scotchman, told him he had often seen the woodpecker storing the acorns, and that it was a black bird with a red head ; but Simson, he said, would introduce me to Dr Trask (author of the geological report herewith sent), and that he would be able to say positively. The Doctor stated that the provident woodpecker is the black one with the red head and yellow throat, that he had observed them repeatedly, and further asserted that they eat acorns, and that he had seen them do it. In confirmation of the possibility at least of their being vegetable feeders, Simson tells me that, in the western country, the farmers frequently clear the woods by cutting the communication of the bark of the trees, and that, where that is done, these red-headed woodpeckers appear in the clearings in perfect swarms, and destroy apples and peaches in these districts to such an extent, that it is impossible to have any fruit. I do not know whether they eat the acorns or the grub that may be in them, but it is most certain that they bore holes in the bark, and hammer

in the acorns so firmly, that you can hardly pick them out again, and afterwards break them open, and eat something that is within the shell. The native Californians are so well acquainted with the fact, that they say when the woodpeckers commence early, it is a sign that we shall have a severe winter. They keep boring the holes all the summer, and are all ready for harvest when the acorns are ripe." His brother adds that Mr Simson came across Mexico with John Audubon (he presumed the son), who watched them, stuffed their skins, and knows all about them. They first observed these acorn deposits in Chihuahua. Mr Murray was inclined to think that the evidence contained in these letters would be sufficient to satisfy the Society, as it had done himself, that there is good ground for believing that *bona fide* acorn deposits are in California stored up for future consumption by a woodpecker.

Dr Lowe moved that the thanks of the Society be given to Mr William Murray, San Francisco, not only for the curious communication which had just been read by Mr A. Murray, but also for the various services he had from time to time rendered to the cause of physical science in general. And Mr Murray was requested to convey to his brother the thanks of the Society.

III. Notice of the Lepidopterous captures near Edinburgh, during the past Season. By Wm. H. LOWE, M.D.

Dr Lowe having been appointed Convener of the Entomological Committee at the last winter meeting of the Society, said, he thought that, although, from the small number of entomologists in Edinburgh, and those for the most part engaged in active professions, little had been accomplished during the past summer, still he had several species of *Lepidoptera* to bring forward as new to the list published by him and Mr R. F. Logan in 1852. As his own captures, he mentioned *Trachea piniperda* (two specimens), *Micropteryx unimaculella*, *Peronea Hastiana*, *Tinea Zinkenii*. To these he had to add *Pterophorus acanthodactylus*, 1851, *Argynnis selene*, 1853, *Satyrus davis*, *Hepialus velleda*, *Cabera exanthemaria*, *Euthemonia plantaginis*, *Xanthia rufina*, *Dosithea reversaria*, all which were owing to the industry of Mr Andrew Wilson of this city, and with the exception of *Cabera exanthemaria*, which had been previously taken by Mr Peter Fairbairn, as well as by Dr Lowe, were additions to the insects of this district. Dr L. also noticed *Coccyx strobilana*, which had been taken in a greenhouse at Newington, and which was traced to a basket of fir cones sent to Edinburgh by Mrs Scott of Gala. Among other insects also observed and taken this year were *Macaria lituraria*, *Spaelotis cataleuca*, *Agrotis obelisca*, *A. putris*, *Caradrina morpheus*, *Hadena adusta*, &c. There was also a fine series of *Dosithea scutularia*, bred from caterpillars, and which, in that early stage of development, had been frozen hard, and left to thaw in the ordinary way, but which had, nevertheless, produced beautiful spe-

cimens. Another brood of caterpillars of a different genus, which had been similarly exposed, had entirely perished. The results of a day's ramble in Castle Eden Dean, in the county of Durham, were included in the insects brought before the Society. Among them were *Dosithea blomeri*, *Pyrausta Punicealis*, *Stigmonota trauniana*, &c.

IV. Mr R. F. Logan exhibited specimens of *Bombycia viminalis*, bred from larvæ found in June on a dwarf sallow on the Pentlands; also a male *Parasemia plantaginis*, taken on the wing near the top of one of the hills on the same day. He also exhibited a specimen of the new British *Zygaena minos*, from the collection of Dr Fleming, in which it had stood probably for the last twenty years, and which Dr Fleming said he had no doubt had been taken by himself in Fifeshire.

V. *Notice of the Scops-Eared Owl (Scops Aldrovandi)*, Will. Orn., shot in Sutherlandshire. By JOHN ALEX. SMITH, M.D.

This rare owl, which Dr Smith exhibited, was shot in the latter end of last May, at Morrish, near Golspie. In the general colour and character of its plumage it reminded him very much of the Nightjar; and is distinguished from our other British owls by its small size, by the incomplete character of its fascial disk, by its having tufts or horns, and also by its rather long and slender legs, closely covered with short mottled feathers, which terminate at the junction of the toes, leaving the toes entirely bare. There is also a series of spots along the edge of the scapulars, the outer half of these feathers being yellowish-white with dark brown tips, contrasting beautifully with the closely mottled and minutely spotted and striped character of the rest of the plumage. It is a bird more especially of the southern and eastern portions of Europe, and from thence it migrates to Africa. Several instances have been reported of its occurrence in England.

VI. Mr A. Murray read an extract of a letter from Sir William Jardine, mentioning a capture of the Ivory Gull (*Larus eburneus*), shot at Thrumster, Caithness-shire. It was sent to him by Mr R. Shearer, Borrowston, near Wick, who has thus added another specimen to the two or three which are known to have been killed in Britain.

Professor Gregory, Edinburgh University, was balloted for, and elected a member of the Society.

Wednesday, Dec. 27, 1854.—Professor BALFOUR in the Chair.

I. *On the occurrence of Oxalates in the Mineral Kingdom. Analyses of two new Species.* By M. FORSTER HEDDLE, M.D.

At this time last year two oxalates were known in the mineral kingdom. The one, an oxalate of iron, was analysed by Rammelsberg, and

named by him Humboldtine; the other, an oxalate of lime, identical in composition with that ordinarily precipitated by the chemist, has been called after Dr Whewell. Some months ago Mr R. Greg of Norcliffe Hall sent Dr Heddle for analysis a few white crystals, which had been found, some five-and-twenty years ago, in a copper mine at the Old Man, near Coniston Lake, in Westmoreland. From a hasty examination of these, Mr Greg was led to suppose that he had found a new substance, and the analytical result proved that he was right. Dr H. found the mineral to be an oxalate of lime, differing from Whewellite in having six additional atoms of water of crystallization. Associated with these white crystals was a purplish-red substance, which, appearing to him to be new, he submitted also to analysis, when it proved to be an oxalate of potash, with ten atoms of water of crystallization. The colour was due to some oxalate of cobalt. It is always desirable that a mineralogist should be able to account for the occurrence of every substance which comes under his notice. This is more especially the case when the substance is of an organic nature, and in general we have little difficulty in satisfactorily explaining even such occurrences. The mineral Humboldtine, for instance, being found either embedded in lignite, or associated with decomposing succulent plants, leaves no room for doubting that, as it is organic in its matrix, so also it is organic in its origin. He was afraid, however, that their ingenuity would be taxed rather severely to account for the three other oxalates which we are now acquainted with, two of these having been found deep in the womb of earth, associated with a metallic lode. He thought there could be little question that they were of secondary formation, having resulted in some way or other from the operations connected with the working of the mine; but he professed to be perfectly unable to offer any explanation which appeared even to himself to be satisfactory. One theory had been brought forward,—a theory which he could not but dissent from; it is, that the minerals were originally bi-carbonates,—that metallic potassium having been brought into contact with them, an atom of oxygen was abstracted, the result being necessarily oxalates. This did not appear satisfactory: neither bi-carbonate of lime or of potash had yet been found in nature; and he could not place himself among those who, whenever they wished to account for volcanic action, or to get out of any difficulty, called in the aid of metallic potassium. He was very far from thinking that no satisfactory theory could be brought forward, but he was content for the present to look upon the occurrence of these oxalates as one of many proofs that as yet we know but too little of the operations carried on in nature's laboratory. The first of these minerals had been named, by Mr Greg, Conistonite, from the locality; and the second Heddite, after the analyst.

III. *Exhibition of a Collection of Liassic Fossils from Pabba and Skye.*
By ARCHIBALD GEIKIE, Esq.

Mr Geikie laid on the table the fossils he had collected, which he illustrated with the following remarks:—The Isle of Skye is an object of special interest to the geologist, from its containing in tolerable abundance the remains of the liassic formation,—one which occurs in but unfrequent patches throughout the whole extent of Scotland. The lias, as developed in that island, stretches from shore to shore in a band about seven or eight miles in length, by from two to five in breadth. Over the greater part of this extent a dark peaty soil covers the strata, so that they are seldom discernible, save where channelled by some mountain torrent. The best exposures are therefore to be found at the extremities of the belt. Broadford Bay, on the east, affords a general section of the formation. The beds are there free from the dislocating effects of trap dykes, and dip gently under the waters of the bay at an angle of 5° . The lowest members of the series are found at the village of Lussay, resting unconformably upon the red sandstone of Sleat. They consist of concretionary sandstones, and dark compact limestones, some of them charged with organic remains. But the most remarkable of these strata is one, irregularly three feet thick, composed entirely of corals of the family *Astreidæ*, which are bound together by an indurated mud. These organisms, of which there are several specimens upon the Society's table, were described several years ago by Mr Miller. They differ in size and abundance from any species in the lias of England, where corals are exceedingly rare; and they thus give a peculiar character and interest to the Scottish deposit. Beyond Lussay beds of sandstone and limestone alternate along the coast. Some of these abound with the characteristic shells of the period. At Breckish, for instance, where the limestone has been broken up in the course of constructing a road, the *Gryphaea incurva* might be removed from the beach by ship loads. The same fossil, mingled with ammonites, belemnites, and pectens, is found in most of the strata as far as Corrie Farm, at the northern point of Broadford Bay, where they are buried beneath an extensive overflow of syenite. The upper members of the series are found forming the flat island of Pabba, about three miles out in the bay. Pabba, though not more than a square mile in extent, forms, with its rich green pasture, a striking contrast to the dark, barren mountains of the surrounding shores. The lias is here represented by a series of dark micaceous shales, dipping northward at the angle usual in this district, 5° . They abound with the organisms of the formation; indeed, so richly charged are some of the beds as to emit a strong foetid odour when rubbed or broken—a fact likewise noticeable in the lias shales of Eathie. There is now on the table a set of these Pabba fossils. The majority have been already noticed by Murchison,

and figured by Sowerby ; but there are several which appear to be new. The most abundant organisms are the *Pectens*, of which there are at least three species. Other fossils are the *Pentacrinites*, *Plagiostoma*, and *Terebratula*, of each of which there are several species—*Gryphaea incurva*, and *G. Maccullochi* ; *Pinna*, probably of several species ; *Belemnites*, *Ammonites*, at least four species ; *Serpulae*, &c. The state of keeping of the fossils varies considerably in the different beds. The ammonites exist, in some cases, as mere flattened impressions. Generally they present only the outer ring, the central portion of the disc having entirely disappeared. In not a few of the layers the condition of the organic remains seems to indicate protracted maceration—a conclusion rendered probable by the abundance of casts of the more tender species. The western coast of Skye, along the shores of Loch Slapin, presents a rich field of study to the geologist. The lias, for the space of several miles, is traversed in all directions by dykes and veins of basalt. In some places the limestone is black ; in others, of different shades of gray ; while inland, towards Kilchrist, it takes a snowy white ; but in all cases it has been altered into a compact marble. A series of specimens upon the table exhibits the passage of a calcareous shale, abounding with *Gryphaea* and *Pecten*, into a hard fossiliferous limestone, which in turn shades off through various hues of black and gray into a white crystalline marble, destitute of organic remains. The latter rock, as it lies in the quarries at Kilchrist, is not much inferior in colour to the best stone of Italy, though, after being cut and exposed for a few years to the air, it acquires a dirty yellowish tinge. The trap dykes are themselves a curious subject for investigation. Owing to the decomposition of the marble around them, some of large size are seen running up the hill sides like walls. Indeed, when two or three cross each other, the appearance presented reminds one of some ruined relic of the feudal times. Others may be found insinuating themselves among the cross rents of the contorted strata, and terminating in a point as fine as that of a pen. The shores of Loch Slapin are, on the whole, one of the most interesting localities in the island ; and a careful examination of them would form a valuable contribution to Scottish geology. The district lies far out of the ordinary track of the tourist, and the accommodation, where it can be had, is not of the best ; but these disadvantages would doubtless be more than compensated by a ramble among the beautiful sections which abound in the creeks and caves of that solitary shore.

IV. *On some Worm Tracks in Silurian Slates.* By ALEX. BRYSON, Esq.

Mr Bryson showed that considerable difficulty was felt in accounting for these curious appearances on the Silurian slates at Thornielee, Peeblesshire. They had been named by Professor M'Coy *Crossopodia Scotica*, or fringe-footed animals. Sir Roderick Murchison described them as occurring of considerable length, even extending to yards. Mr Bryson

was of opinion that the length was merely due to a track made by a worm of about six inches long, in mud of a rather crisp than slimy condition ; and that the different appearances presented by the track, as compared with the surrounding matter, was due, not to the remains of the worm, but to dry dust blown into the track by the wind, on the recession of the ocean, which formed the lowest Silurian beds of Scotland. On the tracks found by Mr Bryson in the Llandeilo flags of Wales, he observed that many naturalists had mistaken for setæ merely the effects caused by wind blowing light sand over tracks made by gasteropodous molluscs ; and stated, that tracks which he found at Port Rheudyn, in Wales, in almost the lowest beds of the Silurian slates, were quite identical with those he saw in the act of formation by the common *Turbo littoreus*, on the sands of Tremadock, a few miles south of Port Rheudyn. Mr Bryson exhibited some very large slabs, showing numbers of these tracks, sent him by the kindness of Mr Chaffers, the lessee of the quarry at Port Rheudyn, Wales.

The following gentlemen were appointed the office-bearers for the session :—

Presidents.—Rev. John Fleming, D.D., Professor of Natural Science, New College, Edinburgh ; Robert Chambers, Esq. ; William H. Lowe, M.D.

Council.—Andrew Murray, Esq., W.S. ; John Coldstream, M.D. ; Patrick Dalmahoy, Esq. W.S. ; J. H. Balfour, M.D., Professor of Botany, University of Edinburgh ; Hugh Miller, Esq. ; Robert K. Greville, LL.D.

Secretary.—John Alexander Smith, M.D.

Assistant-Secretary.—George Lawson, Esq.

Treasurer.—William Oliphant, Esq.

Honorary Librarian.—Robert F. Logan, Esq.

Library Committee.—Wm. Rhind, Esq. ; John L. Stewart, Esq. ; Alexander Bryson, Esq.

Alexander Rose, Esq., Lecturer on Geology and Mineralogy, Edinburgh, and David Page, Esq., were then elected members of the Society.

Wednesday, January 24, 1855.—WILLIAM H. LOWE, M.D., President, in the Chair.

The following Donations were laid on the table, and the thanks of the Society voted to the donors :—

1. Proceedings of the Literary and Philosophical Society of Liverpool. Vol. viii. 1853-4. From the Society.
- (1.) Inaugural Address at the Opening of the Medical Society's New Hall, 1852.
- (2.) Observations on the Canal of Petit.
- (3.) On the Embryogeny of *Orchis mascula*.
- (4.) On the Anatomy of *Actinia*.
- (5.) On the Anatomy of the Giraffe.
- (6.)

Anatomy of the Porbeagle Shark, *Squalus cornubicus*. By T. Spencer Cobbold, M.D. From the Author. 3. Literary Papers of the late Professor Edward Forbes. From Lovell Reeve, Esq., London.

I. *On the Discovery of Diatomaceæ in the Silurian Slates of Scotland.*
By ALEXANDER BRYSON, Esq.

In a former paper, read at the last meeting of the Society, Mr Bryson had indicated a hope that Diatoms might be found in the lower Silurian formations of Scotland, from the peculiar appearance resembling organisms which he observed in a microscopic section of the slate from Thornie-lee* Quarry, in Peeblesshire. One form is identical with a rare species found in the guano of Ichaboe, both in form and colour. In an endeavour to separate the alumina from the silica in the slate he had met with difficulties, as any solvent of alumina also acted on the silica of which he supposed the diatoms to consist. Dr George Wilson suggested the boiling of the powdered slate in Nordhausen sulphuric acid, which was found after a long time to isolate the silica. After many washings of the residue with distilled water, the author found several forms of diatomaceæ, two identical with living species, and four or five quite aberrant. After digestion with nitric acid the organisms seemed fewer, which he referred to their being more horny than silicious.

II. *Notes on a Species of Nostoc or Sky-Jelly* (specimen exhibited by Dr Heddle). By ALEXANDER BRYSON, Esq.

III. *Description of a New Species of Trematode Worm, with Observations on the Structure of Cercariæ.* By T. SPENCER COBOLD, M.D.

Specimens of the worm were exhibited. They had been obtained from the liver of a giraffe, and differed from all known species. Dr Cobbold illustrated his paper with numerous drawings, showing the minute anatomy of this worm, and also several embryonic forms of entozoa.

IV. P. A. DASSAUVILLE, Esq., exhibited a specimen of the Gray Phalarope (*Phalaropus lobatus*, Lath.), which was shot in the Firth of Forth in December last. The bird was only beginning to assume its winter plumage, and appears to be rare in this locality.

V. *Analysis of Datholite from Glen Farg.* By M. FORSTER HEDDLE, M.D.

Datholite, Dr Heddle said, had been found in the British islands in four localities, all of these being Scottish—first, by Mr Rose, on the yellow prehnite of Salisbury Crags; then at Glen Farg in Perthshire, associated with zeolites, and well crystallized; next, upon prehnite, in what is mineralogically called the “Greenockite Hole,” namely, the tunnel on the Glasgow and Greenock Railway; and, lastly, at Corstorphine Hill, by Mr Forrest, within the last few years. It is a fact worth notice, that three out of these four are prehnite localities. This might warrant a

searching examination for boracic acid in prehnite. In all these localities the mineral had been recognised by its crystallographic characters, no analysis of a British specimen having yet been published. A specimen from Glen Farg had been examined by Dr Heddle, and the analysis showed nothing different from those made of foreign specimens, with the exception of 28 per cent. of oxide of iron; and as a second analysis (made upon crystals apparently absolutely pure) gave 24 per cent., Dr Heddle was inclined to think that the iron is the colouring matter, giving the mineral its light yellowish-green or *asparagus stone* tint.

The following gentlemen were then elected members of the Society:—James Wardrope, Esq.; Hugh Redpath, Esq.; Stevenson Macadam, Ph.D., F.C.S.

Wednesday, February 28, 1855.—ROBERT CHAMBERS, Esq., President, in the Chair.

The following Donations to the Library were laid on the table, and thanks voted to the respective donors:—1. (1.) *Transactions of the Royal Society of Edinburgh*, Vol. XXI., Part I. Session 1853-4. (2.) *Proceedings of the Royal Society of Edinburgh*. Session 1853-4. From the Society. 2. *Transactions of the Michigan State Agricultural Society*. 4 vols. 8vo. From the Michigan State Agricultural Society, through the Smithsonian Institute.

I. On the late Severe Frost. By HUGH MILLER, Esq.

In the hope of attracting attention round our shores to one of those catastrophes in the animal world which throw light on the disappearance of species in geological history, Mr Miller stated he had inserted in the *Witness* of last Saturday the following paragraph:—

“ The present intense frost, coincident at new moon with a stream tide, has killed many of the littoral shell-fish around our shores, and they now lie by thousands and tens of thousands along the beach. On the beach below Portobello, and for at least a mile on the western side of the town, they are chiefly of two species,—*Solen siliqua*, or the edible spout-fish or razor-fish, and *Mactra stultorum*, or the fool’s cockle, both of them molluscs, which burrow in the sands above the low water line of stream tides. The spout-fishes, when first thrown ashore, were carried away by pail and basketfuls by the poorer people, and yet of their shells enough remain, in the space of half a mile, to load several carts; but the fishes themselves, devoured by myriads of birds, chiefly gulls, have already disappeared. The Mactra, though they may be picked up in some places by basketfuls, are less abundant. It is probable, however, that both species will be less common on our coasts than heretofore for years to come; and their wholesale destruction by a frost, a few degrees more intense than is common in our climate, strikingly shows how simply, by slight changes of climate induced by physical causes, whole races of animals may become extinct. It exemplifies, too, how destruction may fall

upon insulated species, while from some peculiarity of habitat, or some hardness of constitution, their cogeners escape. There are two species of *Solen* in the Firth, *S. siliqua* and *S. ensis*; but we have not seen, on the present occasion, a single dead individual of the latter species; and, of at least four species of *Mactra*, *Mactra stultorum* seems alone to have suffered."

He had, since the appearance of the above, several times visited the shores in the neighbourhood of Leith and Portobello, and now craved leave to bring before the Society a few additional facts. Up till Friday last, the dead shell-fish consisted almost exclusively of the two kinds specified in the paragraph,—*Solen siliqua* and *Mactra stultorum*. Since that time, however, considerable numbers of the smaller molluses have also been thrown up dead upon the beach; and their later appearance, as he found their remains mingled with very young specimens of the destroyed *Solen* and *Mactra*, may have been the result rather of a mechanical than of what he might term a *constitutional* cause. The greater shells have been first driven ashore, from the circumstance, mayhap, that they presented a larger surface to the waves, and then the smaller, including, in considerable proportions, the young of the large ones. Among the lesser molluses, destruction seems to have fallen more extensively on that delicate shell *Tellina fabula* than on any of the others. *Tellina tenuis* has also suffered, but to a much less extent. Next to *Tellina fabula*, the mollusc of the smaller species that, in proportion to its number, has been most extensively destroyed, seems to be *Donax anatinus*. Every little pool has its numerous specimens of this shell lying gaping and dead. He observed also a few recently killed specimens of *Mactra subtruncata*, but, considering the abundance of the shell on our sandy flats, only a very few; and also, what he had not seen in his previous walks, a few individuals of *Solen ensis*, but scarcely in the proportion of one to a hundred of its cogenet *Solen siliqua*. There were localities, too,—as immediately below the town of Portobello,—in which he found great numbers of the slim and delicate shells of *Syndosmya alba* still inclosing the dead molluses. Among the univalves, he picked up a considerable number of lately destroyed specimens of *Natica monilifera*. There seems to be a peculiar circumstance in the history of this shell which still requires explanation. Fully nine-tenths of the specimens thrown ashore on our Leith and Portobello beaches, in a dead or dying state, have their lip edges fractured and broken, the gaps often impinging deeply into the inner space of the shell occupied by the mollusc. Of ten individuals of this species which he picked up on various parts of the beach on Saturday last, all exhibited the broken lip; of twice that number picked up on Monday, only three had the lip entire; and as much weaker shells come unbroken to the shore, the mutilation must, he suspected, be regarded as the work of some unknown enemy. But the enemy which had killed these naticas was evidently the frost. Besides the molluscs, some of the commoner crustaceans of our coasts appear to have suf-

ferred from the severe cold. He found at two several places, about half-way between Leith and Portobello, great numbers of the common swimmer crab (*Portunus depurator*) lying dead ; the common shore-crab, too (*Carcinus mænas*), seems, judging from the number recently killed, also to have suffered ; and in the perished *Mactra* he detected several specimens of that minute Pea-crab (*Pinnotheres pisum*), which finds shelter within the living shells, and which seem to have shared in the fate of their involuntary hosts. Among the dead crustaceans he found a newly killed specimen of the rather rare masked crab (*Corystes cassivelauanus*), a female laden with spawn.

He deemed it worthy of remark, that there are shells very abundant on the coast, and which, from their littoral character, must have been quite as much exposed to the intense cold as either *Mactra stultorum* or *Solen siliqua*, of which he did not find a single dead specimen on the beach. *Tellina solidula* is one of these species, and *Mactra solida*, with its sub-species or variety *Mactra truncata*, another ; and these the frost seems not to have in the least affected. Of the various littoral univalves, too, including the periwinkles, purpura, and trochidæ, only one species, *Natica monilifera*, seems to have suffered. Now, *Tellina solidula* is in some localities, as at Castleton King-Edward, one of the most numerous and best developed of the boreal shells ; *Mactra solida* is also a boreal species, with the common periwinkle (*Littorina littorea*), the common purpura (*P. lapillus*), and the dog-periwinkle (*Trochus cinerarius*). Again, on the other hand, of the destroyed shells, he had not yet found any trace of *Tellina fabula* or *Donax anatinus* in the old glacial deposits, such as the boulder clay or Gamrie gravels and sands, nor yet of *Mactra stultorum* or *Solen siliqua*, though the former is said to be a shell of the Mammiferous Crag, and the latter of the Clyde beds. And though a large *natica* occurs in both the Caithness and Gamrie deposits, that very considerably resembles *Natica monilifera*, it fails to exhibit the characteristic flexuous streaks, and, in general form, seems at least as much akin to a sub-arctic species as to the one recently killed by the frost. And there could be, he thought, no doubt that the boulder clay *Tellina*, *T. proxima*, is altogether a different species, notwithstanding its points of similarity in the more dwarfish individuals from *Tellina tenuis*. None of the molluses killed in any considerable abundance by the present intense frost seem to be truly boreal species ; and their destruction by the refrigerating agent, which has strewed them by millions along the beach, seems not only strikingly illustrative, as he had said, of one of the modes in which species may be destroyed, but also of a curious passage in the later geologic history of northern Europe. It is an ascertained fact, that shells were living in the British area during the times of the Red Crag, of the same species with those recently killed by the frost ; *Mactra stultorum* is one of these, and *Natica monilifera* another, and they now live in the neighbouring firth ; but he at least had failed, after sedulous exploration, to detect them in the intermediate period of boreal shells, ice-

grooved surfaces, and the boulder clay, a period during which some of their hardier cognates were very abundant. And the catastrophe which has just destroyed them in such numbers shows in part how this passage in our geologic history may have taken place.

Such a depression of a few hundred feet of the North American continent as that suggested by Mr Hopkins, would have the effect of diverting the course of the great Gulf Stream into what is now the valley of the Mississippi, and of sending it northwards over the Lake District into Hudson's Bay and the Polar Seas. The heating agent, which has been said to throw as much caloric in a single day into the Atlantic as would raise the temperature all over France and Britain from the average of that of winter to that of summer, would be lost, in consequence, to Europe; and, left to the natural effects of our high latitudinal position, whole races of the existing molluscs would die in our seas. Scenes such as the one which we witnessed during the recent frost would occur with every returning winter, until only the hardier shells would continue to survive, and gradually and slowly, northern shells, not now living on our coasts, or occurring in but scattered patches and outliers, such as *Panoaea Norvegica*, *Tellina proxima*, *Pecten Islandicus*, and *Astarte arctica*, would take the places of the perished ones. Our Fauna would become a sub-arctic one, like that which now lives in the same parallel on the coast of Labrador, or like that whose remains we find locked up in the Pleistocene deposits of Banffshire, or in the boulder clays of Caithness. And then, an elevation of the American valley to its present level, or to a level approximating its present one, would again give us back the Gulf Stream. A reverse process would take place among our molluscs; the sub-arctic ones would gradually die out in the over warm water, and shells of the same species with those previously killed by the cold would gradually propagate from the southern localities, to which they had been restricted, and occupy their old areas as before. And such, judging from the data furnished by our later deposits, from the Red Crag downwards, seems to have been the geologic history of northern and western Europe. Independently, however, of these views, though he could entertain no doubt that they are ultimately to prevail, any catastrophe illustrative of the extinction of species must be of interest to the geologist. To the mystery of creation he could not attain; but the twin problem of extinction appears to be a solvable one. That law through which, judging from the past, all species are as certainly destined to die as all individuals, seems fairly to belong to the field of experience. He had already referred this season, in one of his communications to the Society, to that mysterious disease which, selecting one of our most useful vegetables, destroyed it over wide areas, and by billions of individual plants, as mayhap illustrative of one of those agents of death through which whole species are exterminated; and the late severe frost, which, equally, though less restrictively, selective of species, has strewed our shores with heaps of dead shell-fish, seems not less illustrative of another and better appreciable

agent. It shows how, through those physical changes which have been taking place in every geological era, and which, by altering the geography, have also altered the climate, of wide regions, whole races may have been extinguished.*

II. *On the Silurian and Old Red Floras of Scotland.* By HUGH MILLER, Esq.—Mr Miller illustrated his paper by the exhibition of a most interesting collection of the fossil remains of these little-known plants.

III. *On the Homology of the Vertebrate Skeleton, and its representative Eso-Skeleton of the Invertebrate Classes, with the application to Zoology, Palæontology, and Geology.* By Professor M'DONALD.—The Professor exhibited a numerous collection of osteological preparations and diagrams in illustration of his peculiar views.

Wednesday, 28th March 1853.—Professor FLEMING, President, in the Chair.

The following Donation to the Library was presented from the Author:—“A List of the Mollusca hitherto found in the Province of Moray.” By the Rev. George Gordon, Birnie.

I. *Of Some Circular Mounds, covered with a Metallic Slag, which occur on the Sloping Sides of the Gneiss Hills, Parish of Birnie, Morayshire.* By WILLIAM RHIND, Esq. (A specimen of the slag was exhibited.)

Several deposits of this metallic matter occur in circular, somewhat elevated, mounds, about four feet in diameter, lying upon the moss-soil of the moors, both in this locality and in some of the moorland slopes of the country to the westward, the vague traditions of the county being that they are the remains of iron-works, used by the armies that had in former times passed over the country. A discussion ensued, in which Professor Fleming, Mr Alexander Rose, and others, took part, on the probable cause of the formation of this metallic matter,—whether it was accumulated by fires occurring in the moors, or by solution, and subsequent deposition

* On the night of the 16th ultimo, the thermometer of the Botanic Garden, Edinburgh, stood as low as 1° above zero. Mr Miller was informed, however, by Mr George Berry, Rosefield Cottage, who, in the behalf of science, carefully notes the extremes of temperature in the Portobello district, that the greatest cold indicated during the late frost, at nearly the level of the sea, in the locality in which so many molluscs were killed, was 9 $\frac{3}{4}$ ° above zero during the night of the 15th-16th, and 9 $\frac{1}{2}$ ° during the night of the 16th-17th. On the coast of Labrador, in the same latitude, the sea freezes every winter for many miles from the shore, and the ice, even in mid-summer, never melts in the ground beneath a certain depth, but forms a rock-like subsoil. It is thus evident that the shells killed by the recent frost at Portobello could not live in the same parallel on the American coast.

from water. Similar slags were exhibited by Professor Fleming from Maryculter, Aberdeenshire. An accurate analysis of the mineral was recommended, and a report to be given in to the Society at its next meeting.

II. Contributions to the Hydrology of the British Islands. By WILLIAM RHIND, Esq.

The peculiar position of the British Islands, in the great trough of the North Atlantic, by which they are brought within the influence both of the Gulf Stream and of the equatorial air currents, has a marked effect in modifying their climate. By both these influences the winter temperature is greatly mitigated, in comparison with that of the corresponding parallels on the Continent of Europe and Asia, while the intensity of the summer heat is also tempered by the surrounding ocean. For fully two-thirds of the year the prevailing winds in Britain are the south, south-west, and north-west. The south-westerly winds are predominant from June to the end of December, while the easterly current prevails from March to the end of May. The southerly winds originating in the tropics, and blowing over the Atlantic Ocean, whose temperature is kept up by the influence of the Gulf Stream, are of elevated temperature, and highly charged with moisture. The north-easterly winds, on the other hand, coming from circumpolar regions, and blowing over a long tract of continent, are chill and dry. To the contact and opposition of those two currents then, as is well known, we owe to a considerable extent our rainy weather; the cold east wind becoming the condensing agent. But we shall find that besides the north-easterly currents there are other condensing agencies constantly at work.

In collecting materials for the Hydrology of the British Isles, in connection with Mr Keith Johnston, for the second edition of his Physical Atlas, the author had obtained, from published and unpublished sources, upwards of one hundred records of rain stations and temperature. These amounts were marked down in their respective positions on the map of Britain, and this map was coloured with light and dark shades according as the amount of rain-fall was small or large in the locality. The map he exhibited showed, in the first place, what had been already done, and what parts of the country yet remained to be filled up by observation and registration. A considerable portion of the surface of Britain and Ireland was observed to be dotted with figures, but a large part of Wales and the north-west coast of Scotland were deficient. If we take three waving lines along the map of Great Britain we shall meet with three gradations of rain-fall. The line along the east coast, and penetrating some way into the interior, marks out the region of least deposition. On the whole eastern side of England, from Kent and Surrey, and Oxford, north to York, the average annual fall of rain is 23 to 24 inches. From Durham, north into Scotland, the mean fall is 27 inches, though in some localities, as Mid-Lothian and Morayshire, the rain-fall is from 24 to 25 inches. The mean annual rain-fall of the whole eastern half of Great Britain is 27 inches.

If we take a middle line, which includes the mountain range that traverses England from south to north, and extends through the centre and west of Scotland, we find that here is the greatest amount of deposition. In the mountains of Cumberland and Westmoreland, from 50 to 140 inches of rain fall annually. South of this range throughout England, from 36 to 46 inches are deposited. In Scotland, from the Lowther Hills to the mouth of the Clyde, from 47 to 50 inches. A third line embraces the west coast near the level of the sea. At Land's End, the annual fall is 42 inches, in Exmoor, 56 inches. As we proceed farther north, the mean fall decreases to 38 and 35 inches. Taking the western half of Britain, including the mountain regions, the annual mean of the rain stations is 45.5 inches, but considering that there is a deficiency of data for the elevated regions of Wales and the north-west of Scotland, and a preponderance of coast stations where the fall of rain is moderate, we may suppose that the actual fall for the western half of Britain is at least 5 or 10 inches more than this average; that is, from 50 to 55 inches. We thus see that the mountain regions of Britain, by their superior elevations, compared with the valleys and plains, and by the consequent diminution of their surface temperature, become the condensers of the moisture of the warm and moist southerly winds. From the interesting data of Mr Miller of the Lake district of England, it is also demonstrated that the greatest amount of deposition takes place at an elevation of 1900 feet, and above this, the fall of rain rapidly diminishes.

In Ireland the greatest amount of rain-fall occurs on the south-west coast, 59 inches falling in the vicinity of its highest range of mountains. In the low lying central plain of Ireland the annual fall is 23 and 24 inches, while on the mountain ranges of the north-east and south-east from 30 to 37 inches fall.

If we divide the year into three periods of four months each, beginning the winter period with November, we shall find that most rain falls in the summer and winter months, and least in spring. This is shown in the following tabular view:—

	Inches.	Spring.	Summer.	Winter.
		Inches.	Inches.	Inches.
Penzance, Cornwall,	12.2	13.5	17.4	
Keswick,	16.0	24.0	19.9	
Glasgow,	8.3	9.8	15.5	
Gilmourton, Lanarkshire, . . .	11.6	17.3	18.8	
Glencorse, Pentlands,	10.2	14.3	11.6	
London,	6.7	9.2	8.9	
Boston,	7.2	9.4	6.5	
York,	7.3	10.0	9.9	

On the east coast there are during the year 165 days on which rain falls; on the west coast there are 212 days on which rain falls. The greatest

depth of rain noted to have fallen in twenty-four hours, is from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches. At Kendal, in 1792, $4\frac{1}{2}$ inches fell. Our longest continued rains usually begin on the south and west of Great Britain, and proceed northwards. This occurs when an easterly and south-west current both prevail in the atmosphere. In these cases it sometimes takes several days before the dry east wind becomes saturated with moisture, and rain begins to fall on the eastern coasts. Hence the popular idea that our greatest rains come from the east, whereas, in reality all the deposited moisture comes with the southerly current, and the cold east wind acts merely as the condensing agent.

In the end of the year we generally have a south-west wind prevailing, often with great violence, somewhat in the form of a monsoon. About a month or six weeks after the autumnal equinox, when the sun has proceeded so far in its south declination, the atmosphere of the whole northern part of Asia, hemmed in on the south by the highest barrier of mountains in the world, becomes cooled down to a very low pitch. This highly condensed atmosphere then begins to make its way southward by the east of Asia, and forms, in fact, the north-east monsoon of the Peninsula of Hindustan and the Eastern Archipelago. To supply this eastward current, a south-west current rushes from the equatorial regions, and sweeps over the North Atlantic, passing over Britain and the middle of Europe. This continues more or less during the months of November and December, and is accompanied by a great deposition of moisture. An equilibrium of the northern atmosphere is brought about in our mid-winter, and then commences the season of our northerly and easterly winds. In so far the laws of our apparently inconstant climate may be wrought out. The average direction of winds, and the temperature and fall of rain, in a series of 15 or 20 years, will be found to be remarkably constant. There are, however, occasional irregularities either of mild or severe, of dry and wet seasons, which are not so easily referable to any known or defined laws. It has been beautifully demonstrated by Professor Dove, that as respects the temperature of the whole globe, and also the respective hemispheres, there is a perfect uniformity year after year: Thus, that the same amount of warm currents passes yearly from the equator to the poles, while this is balanced by equivalent currents of cold air from the poles to the equator. These respective currents, however, as regards our northern hemisphere, may pass in varied lines of longitude. So that while in the meridian of Europe we may have for one or more successive years an excess of the southerly currents, these currents in other years may pass along the meridian of America, or of the Atlantic or Pacific Oceans. That such variations actually take place, there can be no doubt, and more extended observation is daily more precisely defining and recording these occurrences; but the laws which regulate these variations yet remain unsolved, and are perhaps of too refined and complicated a nature to come within the grasp of man's limited observation.

III. *On the Discovery of Calcareous Zoophytes in the Boulder Clay of Caithness, N.B.* By CHARLES W. PEACH, Esq., Wick.

Zoophytes have not hitherto been discovered in the boulder clay of Caithness, but the author laid before the Society specimens of two species, one found by Mr Dick at Thurso, the other by himself in the scur in Wick harbour. The former, which was much rubbed, proved to be the *Lepralia simplex* of Johnston, the latter the *Lepralia Peachii*, both of which now exist in our seas. The only perceptible difference between the recent and ancient specimens, is, that the latter have thicker walls to their cells, probably as a provision against the boreal clime and more troubled seas they were denizens of. Besides this addition to the fauna of the boulder clay, he mentioned that its flora has yielded some of those curious calcareous plants, the *Melobesia*. He proposed in a future communication to lay before the Society the details of a microscopic examination of these plants.

IV. ANDREW MURRAY, Esq., then read a short notice he had received from Sir W. Jardine on the *Bark-boring Woodpeckers of California*.

V. *Analyses of Pectolite from Mourne Mountains, and Table Spar from Girvan.* By M. FORSTER HEDDLE, M.D.

These analyses have already appeared in the Philosophical Magazine for April and June 1855, pp. 248 and 452.

VI. DR JOHN ALEX. SMITH exhibited an adult male, female, and young male of the Gadwall duck (*Anas strepera*), shot on the Forth, near Kinocardine, in the beginning of this month; Captain Ord, 42d Highlanders, to whom he was indebted for being able to exhibit these ducks, which appear to be very rare visitors to this country, was attracted by their unusual appearance in the shop of Mr Muirhead, poultrey, Queen Street. Dr Smith had made particular inquiries at Mr Muirhead, who informed him there could be no mistake as to the locality the birds came from. He might mention it was only in very open winters the poulters required to get supplies from foreign markets, while in severe seasons like the present there was no scarcity of birds nearer home, to be procured at much less expense. Dr Smith also exhibited two adult males of the Smew (*Mergus albellus*, Linn.)—these birds, which are rarely seen in Scotland, were killed near Mountblairey on the River Doveryon, in Banffshire, in February and March; and a specimen of the Glaucous Gull, *Larus glaucus*, taken on the Firth of Forth last autumn.

Wednesday, 25th April.—ROBERT CHAMBERS, Esq., President, in the Chair.

I. *Remarks on Rain Gauges, with the view of securing Comparable Observations.* By Professor FLEMING.

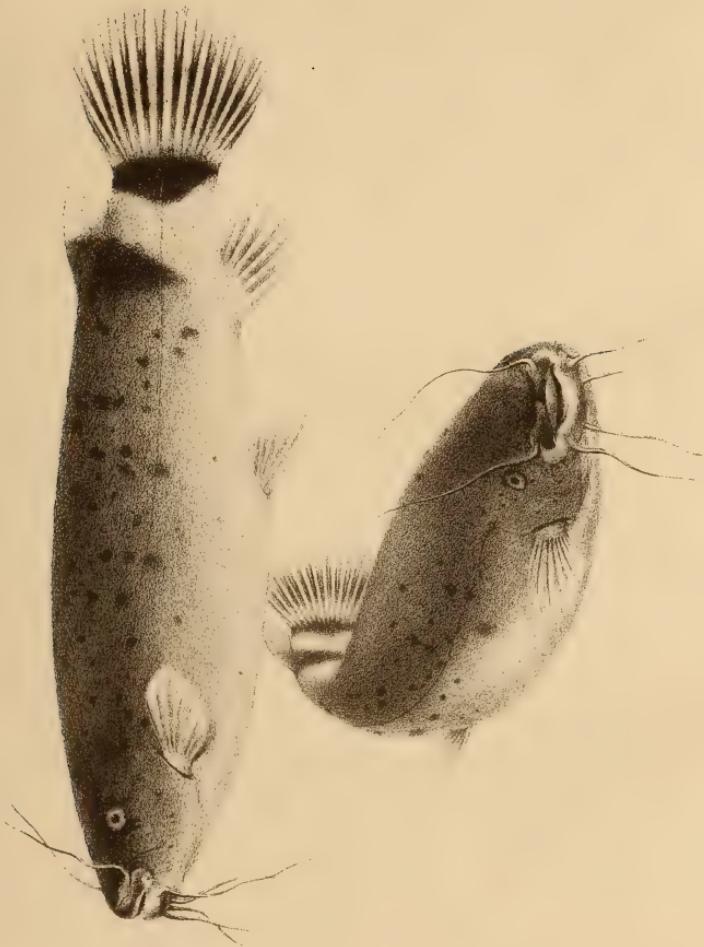
In this communication, made at the request of the Society, Professor

Fleming remarked that the expensive forms in which rain-gauges were usually constructed, making their price range from two to four guineas, rendered these instruments comparatively rare. The gauge which he recommended and exhibited to the Royal Society of Edinburgh, 16th April 1849, was fully described in the *Edinburgh New Philosophical Journal* for July following. In its most expensive form, and made of copper, by Mr James Bryson, optician, Princes Street, it will cost about L.1. Its price, however, could be reduced one-half, or even three-fourths, by constructing it of sheet zinc or common tinplate. The position of rain-gauges was next adverted to by the Professor, who stated, that visiting the Isle of Glass, in the Hebrides in 1821, and questioning Mr Reid, the keeper of the lighthouse, as to the working of a rain-gauge which had recently been erected, according to the form used at the other stations, he was assured that its indications were trustworthy in calm weather; but during rain with wind, his boat in the neighbourhood was often filled with water, while the gauge remained nearly empty, adding that the rain-drops which at such a time fell into the funnel were swept out again by the eddy wind. Reflecting on this circumstance, and others of a similar kind, Professor Fleming became convinced that rain-gauges placed on the tops of houses, or even a few feet above the surface of the ground, were comparatively useless. The late Mr Thom of Ascog, in Bute, arrived at the same conclusion, so that the gauges which he employed in estimating the quantity of available water for mill-dams were sunk into the ground in a grass plot, the mouth of the funnel being nearly level with the surface. In this position the disturbing influence of the wind is removed, while the equable temperature of the ground prevents the evaporation in the cylindrical receiver. The rain-gauges employed at the lighthouses "are elevated $4\frac{1}{2}$ feet above the ground;" and Mr Thomas Stevenson, C.E., having issued queries to the keepers, received, among others of a similar kind, the following answers:—"Lighthouse, Inchkeith.—When the wind is high, no snow and very little rain goes into it." "Buchanness.—When there is little or no wind, it is pretty near the truth; the more wind, the further from the truth." The gauges referred to by Dr Miller in his paper on the Meteorology of the English Lake District (*Ed. Trans.* xxi., p. 81) appear to be placed two feet above the ground, and are thus objectionable in their position, and the accuracy of the indications doubtful. The author stated as the result of experiment, in accordance with theoretical considerations, that rain-gauges need not exceed three inches in diameter, that the trouble attending them may be limited to emptying them once-a-month, and that the index rod, if divided into tenths of an inch, is sufficient for all practical purposes. The eye with a very little practice can easily read off to one-fourth of a tenth, a difference often greater than the amount of rain falling at the same time within short distances. He mentioned that gauges of the description which he had recommended were being established in different parts of the country. Twelve parish schools in Annandale were furnished with them by Mr

Bryson, for his Grace the Duke of Buccleuch, and the results, according to Mr Stewart, Hillside, Lockerby, have been satisfactory. In conclusion, he remarked that trustworthy observations would not be secured, for generalizations respecting the distribution of rain, until some simple, easily constructed, and inexpensive but accurate form of gauge be adopted, such as he believed his instrument to be; and sunk in a grass plot, as free from the influence of trees, buildings, or local currents of wind as practicable, the grass around the funnel being occasionally trimmed.

II. *On Electrical Fishes; with a description of a new Species of Malapterurus from Old Calabar, received from the Rev. Hope M. Waddell, Missionary there.* By ANDREW MURRAY, Esq., W.S.

This paper, which will be found *in extenso* in the *Edinburgh New Philosophical Journal*, New Series, vol. ii., commenced with a review of what is known on the subject of electric fishes. After narrating the various discoveries made by Walsh, Cavendish, and others, down to Faraday's recent investigations, Mr Murray passed in review the different fishes to which electric properties belonged, or were supposed to belong, describing the electrical organs peculiar to each as he went along:—The *Raia torpedo* (*Torpedo vulgaris*), *Torpedo galvanii*, *T. trepidans*, *T. hebetans*, *T. marmorata*, *Narcine brasiliensis*, *N. indicus*, *N. timlei*, *N. tasmaniensis*, *Astrape capensis*, and *A. dipterygia*, were specified as belonging to the Ray family, and the singular organ in the tail of the skate was commented on. The *Rhinobatis*, the *Gymnoti*, (*G. electricus*, *G. fasciatus*, and *G. aequilabiatus*), were severally noticed. The experiments on the *G. electricus*, and discoveries made through them, being detailed at some length. The title of the *Trichiurus electricus* and *Tetradon electricus*, to be considered electric fishes, was next discussed, and, after giving some interesting details relating to the *Silurus glanis*, as representing the family to which the *Malapteruri* belong, Mr Murray narrated what was known of the *Malapterurus electricus* found in the Nile, and, from evidence which he quoted, expressed his conviction that there were more species of *Malapterurus* than the Nile species. In conclusion, he gave the description of a new species sent to him from Old Calabar by the Rev. H. M. Waddell of the United Presbyterian Church Mission stationed there. And to it he had given the name of *M. Beniensis*, as marking the locality in which it had been discovered (see Plate). From the description given, it appeared that the principal differences between the *Malapterurus electricus* and this species are the following: The former is a larger fish, reaching 14 and even 21 inches in length, while the ordinary dimensions of this would appear to be from four to eight inches. The formula of the number of rays in the fins of the two fishes also differ. The number in the ventrals and caudal are the same, but the Nile fish has nine in the pectoral and twelve in the anal, while in this fish there are respectively only eight and eight. In the *M. elec-*



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MALAPTERURUS BENINENSIS Murray.

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tricus, the upper jaw slightly projects over the under. In this species the reverse is the case, the lower jaw projecting decidedly (though not very far,) in advance of the upper. The barbule on the upper jaw of *M. electricus* is a third shorter than the head; *Beninensis* has it longer than the head. In the former the gill-opening terminates at the lower edge of the pectoral fin, in the latter the pectoral fin is attached at the middle of the gill-opening, and its lower edge does not nearly reach the base of the gill-opening. It will also have been seen that there are some differences in the relative proportion of the different parts of the two fishes, and there are also some other differences in the form of some parts of the fishes (such as the operculum) which are not so readily embodied in words, but the differences which will most easily enable them to be distinguished at a glance are the markings, if these shall be found to be constant. The spots on *M. electricus* are much larger and more numerous than on this species, and it entirely wants the white bands across the tail, and across the caudal fin, which were described by Mr Murray.*

III. Mr Murray exhibited a collection of *Coleoptera*, which he had received from Mr Jameson, Professor of Chemistry at Quito. Among these were *Oxychila bipustulata*, *Phanaeus conspicillatus*, *Semiotus imperialis*, and other known Columbian species, but a number were new to him, and apparently undescribed.

Mr Murray also exhibited a few *Coleoptera*, taken by his friend Captain Macneill, of the 20th Regiment, in the camp before Sebastopol during the past winter. These included fine specimens of *Hammaticherus heros*, *Lucanus serricornis*, and some other species, which, besides their beauty and rarity, possessed an additional interest from the locality and circumstances in which they were collected.

IV. Anatomical details of the new species of *Malapterurus*.

By Professor GOODSR.

Professor Goodsr stated, that as he had only received the specimen of *Malapterurus* a day or two before the meeting, it was impossible for him to do more than merely make a few remarks on the subject. He would, however, be glad to give a detailed communication to the Society next session, after he had made a careful dissection of this very interesting fish. The Professor then, after reviewing shortly the results of Pacini's recent examination of the electrical organs of *Torpedo*, *Gymnotus*, and *Malapterurus*, and his own examination of the presumed electrical organ in the tail of the skate, discovered by Dr Stark, and subsequently described by Robin, stated that, so far as his own dissection had proceeded, the structure of the specimen of *Malapterurus*, for which he had been indebted to Mr Murray, corresponded to the description of Pacini, with the exception of

* Since Mr Murray's paper was read he has received older and larger specimens from Old Calabar, from which he finds that these white bands disappear in the full-grown fish.

the structure of the electrical organs themselves, in which he had hitherto failed in detecting lozenge-shaped plates or octahedral cells, but could make out only a fine fibrous meshwork, permeated by a gelatinous granular substance, as had been previously stated by Geoffroy. The presumed inner electrical organs he found, as Pacini had described, to be merely fibrous membranes, with subjacent fatty deposits.

V. Dr LOWE exhibited some interesting specimens sent home by the Rev. Mr Waddell. Among these was a lizard, evidently belonging to the *Monitor* class of lizards. It was about a foot in length, and beautifully banded and spotted, bearing a close resemblance to the figure given in the ninth volume of Cuvier's Animal Kingdom as *Monitor pulcher* of Leach, but differing from that species by the rings on the tail being continued to the extremity. Two large myriapods,—one, which appeared to be *Julus maximus*, was about seven inches long, having fifty-four rings. It was a male, the very remarkable organs of reproduction being very conspicuous on the sixth ring. The last ring but one was prolonged so as to almost form a tail. On each leg, except on the first three or four pairs and on the last seven or eight, was a remarkable gland-like body, situate on the joint immediately before the claw. These were probably analogous to the bodies observed in the foot of flies, and for the same purpose, viz., to assist in walking. The other *Julus* was evidently a female, as shown more particularly by the fringes on the sixth ring. This specimen measured no less than nine inches, and had sixty-six scales or rings. Although a difference of sex might account for some variety of appearance, Dr Lowe had no doubt that this specimen belonged to a distinct species. In particular, he pointed out the beautiful sculpture to be observed upon its surface, and the greater length of the antennæ. The penultimate segment also was not in any degree prolonged, and the legs were provided with two instead of one of the gland-like bodies already mentioned. Lastly, Dr Lowe showed two cockroaches of an unusual appearance, and some spiders, the whole of which had been sent by Mr Waddell, to whom the Society had already been so much indebted for various objects of the highest interest.

VI. *Analysis of the Morayshire Slag*, exhibited by William Rhind, Esq., at last Meeting. By M. FORSTER HEDDLE, M.D.

The author stated that the extreme brittleness of this substance, the number of vesicular cavities, the pavonine lustre of its fracture, and the separation of minute specks of *metallic* iron, showed that it was indubitably a *slag*. In the qualitative analysis he obtained silica, alumina, lime, oxides of iron and manganese, magnesia, potash, soda, and a trace of phosphoric acid. The quantity of silica is 24.045, of alumina 14.410, of lime 2.184; the proportions of magnesia, potash, and soda being small, he did not determine, and the large excess obtained in the analysis, when the iron was calculated as *peroxide*, showed that a considerable portion of it (about

one-third) must have been present in the metallic state ; the total quantity calculated as metal is 52.370 ; the manganese he did not separate from the iron, because the quantity was small, and could not in any way affect the decision that the substance was a slag.

Upon the whole, the opinion of Dr Fleming, as stated at last meeting, seemed to be established, that the substance in question was neither an ore of manganese nor a bog iron ore, but a slag arising from the burning of a bed of peat during a dry season, melting a ferruginous soil.

VII. *Notice of the Discovery of Fossils in the Limestones of Durness, in the County of Sutherland.* By CHARLES W. PEACH, Esq., Wick, Corresponding Member of the Royal Geographical Society of Cornwall. (The Fossils were exhibited.)

The author, after stating that the limestone beds of West Sutherlandshire had been referred by Mr Hugh Miller to the old red sandstone formation, although the absence of fossils had prevented his asserting this positively, stated that he had been fortunate enough to detect in the limestone of Durness distinct traces of spiral shells, probably *Gonatites* or *Clymenia*, which exist, though not abundantly, between Balnakiel and the Kyle of Durness. He had found these fossils from the Auld Kirk yard of Balnakiel, to nearly a mile towards the Kyle of Durness, and some distance inland, as well from the level of the beach to 200 feet above. In the field wherever the limestone showed, he found them. It was true he got but few,—the hardness and splintery fracture of the limestones, with the short time he had to spend there, prevented him from doing more. He ventured no opinion as to the age of the rocks, nor any speculation regarding them, for it would require much more information than he at present possessed, before doing so. Besides the whorled shells, coral-like markings were very abundant, as well as the pipe-like forms found by Mr Miller in the quartz rocks of Assynt. He found amongst the blocks scattered over the face of the country around Durness, and on the tops of the dykes, several containing these strange forms, and he immediately detected their similarity to those he had found at Goran Haven, Cornwall, in the quartz rocks. The Cornish ones he described in a paper published by the Royal Geological Society of Cornwall, as like the sandy tubes made by the *Sabellaria alveolata*, so abundant on that coast, and occasionally found on all the coasts he was acquainted with. He still saw the resemblance in the Sutherland ones, and it would be a very interesting fact if, besides these "pipes," Trilobites, *Orthidæ*, &c., should be found in the Assynt quartz, as well as the Cornish.

Mr Hugh Miller stated at the close of Mr Peach's paper, that he had twice visited the north and west of Sutherland, in order to acquaint himself with the character and relations of the formation in which Mr Peach had been so successful. But though he had examined with some little care the cherty concretions of the limestone of Durness, he had found no such decided organisms as one at least of the specimens on the table.

The apparent whorls in the rock had attracted his notice ; but the region was one in which mistakes had already been made ; Maceulloc had regarded the white cylinders of Stonechrubie as organic ; and the late Mr Hay Cunningham had fallen into what was deemed a similar mistake respecting the supposed tubes of Loch Erribol ; and as he could get no such unequivocal organisms as the one on the table, he did not venture to come to any conclusion regarding them. One well-preserved fossil, however, serves to throw light on many obscure ones, and such was the cast specially referred to by Mr Peach, now before the Society. It was evidently that of a whorled shell, though, as its whorls were not on the same plane, neither a *Clymenia* nor a *Goniatite*. It was not, improbable, however that the other whorled shells on the table belonged to the former genus—a genus of which no fewer than forty-three species had been found in the old red sandstone of other countries. Mr Miller then went on to show the stratigraphical relations of the Durness limestone. It was overlaid, he stated, by a vast deposit of quartz rock, corresponding apparently to the sandstone of Tarbat Ness and Dunnet Head, and underlaid by a coarse-grained red sandstone, the analogue, it would seem, of the Great Conglomerate ; while the limestone itself appeared to belong to the same geologic horizon as the flagstones of Caithness and Orkney, and the fish-beds of Cromarty and Ross. No very decisive finding, however, could be based on the organisms yet found ; and Mr Miller concluded by remarking, that he trusted Mr Peach would have some farther opportunity furnished him of following up a course of discovery so interesting in itself, and on which he had entered with such decided success.

VIII. Dr JOHN ALEX. SMITH exhibited two adult specimens of the Water Rail, *Rallus aquaticus*, Penn., captured by his friend Dr John Messer, R.N., on board H.M.S. *Arrogant* in the southern entrance of the British Channel ; one on the 12th October 1853, in lat. $49^{\circ} 27' N.$, long. $8^{\circ} 3' W.$; the other on the 13th, in lat. $48^{\circ} 55' N.$, long. $5^{\circ} 22' W.$; facts probably of some interest in favour of at least a partial migration of this bird taking place. A remarkably pale-coloured or nearly white specimen of the Ring-dove which had just been shot in Fife, was also exhibited ; and a curious piebald variety of the Mole, recently caught near Cramond.

The Society then adjourned to the fourth Wednesday of November.

PROCEEDINGS
OF THE
ROYAL PHYSICAL SOCIETY.

EIGHTY-FIFTH SESSION, 1855-56.

Wednesday, November 28, 1855. Professor FLEMING in the Chair.

The following Donations to the Library, sent through the Smithsonian Institution, were laid on the table, and the thanks of the Society voted to the donors :—

1. Eighth and Ninth Annual Reports of Board of Regents.
2. Catalogue of Publications of Learned Societies, and Periodicals in the Library of the Smithsonian Institution, Part I., January 1855.—From the Smithsonian Institution.
3. Report of Commissioners of Patents for 1853—Agriculture.
4. Report of Commissioners of Patents for 1854—Arts and Manufactures.—From United States Patent Office.
5. Report and Charts of Cruise of U. S. Brig Dolphin, 1854.—From Lieutenant Lee, Naval Observatory, Washington.

I. Professor FLEMING then delivered the Opening Address as follows :—

GENTLEMEN,—Six years have elapsed since I had the honour and the pleasure of addressing you from this chair. We were then looking back to the comparatively short period which had elapsed since, on the revival of the Society, we commenced our labours of progress. But although our term of labour had then been short, we had occupied it so successfully that I could, without flattery or reservation, congratulate you on well-executed observations, and express a confident hope that our harvest in future would be still more productive. Every succeeding session has fully realized our expectations ; and the Physical Society, as an association energetically devoted to the study of the departments of science to which we restricted ourselves, may be viewed as an important fact.

It seems to be acknowledged by all who have been engaged in the business of the Society, that its operations have been productive of two important and beneficial results. In the first place, it has made kindred spirits acquainted with one another, and called forth a large amount of sympathy and excitement to labour. In the second place, it has imposed an obligation to contribute materials for our meetings. Many of the members have willingly discharged their obligations ; and in the papers which have been read, will be found, in various departments of science, new and important truths, fully qualified to stand comparison with the productions of other Societies with far higher pretensions. The propriety and truthfulness of this statement will become apparent to all who look over the record of our Proceedings, now, by the judiciousness of our Secretary, about to be furnished in a more accessible and useful form than heretofore. Thanks to the prudent management of our Treasurer, our income exceeds our expenditure, and, I may add, our Library is increasing. New members are, from time to time, being added to our list, and we confidently expect new applications for enrolment from such as are thirsting after knowledge, or have truths to communicate. Here I may take the liberty of observing, that perhaps some improvement may be effected in the publication of our contributions, so as to give to our labours a position which they do not occupy,—likewise a more suitable place of meeting should be sought after. Were the leading literary and scientific societies of Edinburgh to unite in an application to Government for the erection or appropriation of a suitable building for their accommodation, the prayer of their petition would, in all probability be granted. Already the Architectural Institute of Scotland has begun to move in the matter, and I trust they will receive our cordial co-operation. When referring to other societies, I may here mention that a movement was in progress a year ago to effect a junction of the Wernerian Natural History Society, which had become dormant, with our Institution. The late Professor Edward Forbes entered cordially into the scheme ; and the amalgamation would probably by this time have taken place, if his life had been spared to science. Should the subject be again considered, and over-

tures made to us, I hope I may venture to say that they will be received and considered in a kindly and liberal spirit.

When I last addressed you from this chair, I took occasion to point out the very defective state of our public collections for purposes of study, noticing, in course, the Museum of the University, of the Highland Society, and other corporations. Many members of this Society cordially entered into the views then enunciated, and a resolution was formed to make a vigorous effort to have a public collection established worthy of the present state of science and the Scottish metropolis. The remarks which I then made, and which were published in a separate form, along with a leading article from the pen of the Editor of the *Witness*, produced a powerful effect on several individuals, and especially the members of the Highland Society, who awoke from their slumbers, and were made to feel ashamed of the indifference to the interests of the public which had been displayed. In the first instance, I enjoyed, of course, my full share of abuse for presuming to hint at imperfections existing. By degrees, however, the sense of the community detected the folly of the “let alone” opponents of the measure,—“let well alone” being a phrase which no one dared to employ. Fortunately, at this stage of the process, an agitation took place regarding the Trigonometrical Survey ; and “Justice to Scotland” sounded somewhat loudly.

The gratifying intelligence at last reached us that the Board of Trade had resolved to institute an Industrial Museum for Scotland in Edinburgh. Judging from my limited source of knowledge, I may state, that no one laboured more earnestly in the accomplishment of the object than Mr Maxwell, the present judicious and energetic Secretary of the Highland Society. In the progress of arrangements, it was recommended to the Board and adopted, that the curator should be a chemist. The propriety of this step did not seem to many to be very apparent, especially as the products with which the naturalist is conversant, and the applications of mechanical philosophy, appear as intimately connected with our industrial progress as the science which has been thus favoured. Accordingly, Dr George Wilson was appointed ; and no one acquainted with his talents and zeal begrudged him the honours or the emolu-

ments of office. Grounds have been purchased, plans framed, and everything but the execution seems progressing. Nay, more, Government, unsolicited, as far as has appeared, by any of the representatives of Scottish Colleges, Scottish industry, or Scottish science, and without a precedent in any of the usually more highly-favoured towns of the empire, gave to Edinburgh a "Regius Professor of Technology," and bestowed the chair on the Curator of the Industrial Museum. Multitudes wondered what this title could mean, what subjects would be discussed, what science would be selected for application, what arts for illustration. The older Professors, it is understood, are still to point out the practical application of those branches which they teach, while the technologist is to limit his enterprise to the uncultivated spots, so that collision may thus be avoided. As intimately connected with the subject we have just been considering, I may mention that the late Professor Forbes had begun to place the Museum of the University in a condition more favourable for study, and was disposed to render the specimens more accessible to the students of Natural History. His successor has entered upon his duties evidently cherishing the same high-minded, liberal views. Hence, what we looked forward to, or rather tremblingly hoped for, six years ago, we are now on the eve of seeing realized. If we had done nothing else in our day than originated and accelerated the movement which has produced the changes above referred to, our existence as a philosophical association has not been unprofitable.

Several articles have of late appeared in the newspapers, calling the attention of the Edinburgh public to an abuse of a bequest for a scientific purpose, unparalleled perhaps in the history of corporation jobs. It appears that a sum of money, exceeding £1500, was received by the Magistrates of Edinburgh in 1821, from the funds of the late Dr Thomson of Palermo, for the endowment of a Lectureship for the promotion of Mineralogy in the University. Conditions were prescribed and accepted,—his minerals and cabinets were secured. But to this hour these conditions have been evaded—no lectureship has been instituted,—the funds have been misapplied; thus leaving the lovers of mineralogy, of which we have several in

our Society, to lament that the confidence of the donor, and the interests of science, have been so egregiously cheated. In the meantime, and before adopting any measures for the public benefit in connection with the subject, let us express our earnest hope that the newly-elected magistrates will bestir themselves and wipe off the disgrace.

Suffer me, before retiring, to thank you for the honour you thrust upon me as your President—an office I willingly resign into abler hands, and, wishing you all prosperity, bid you farewell.

On the motion of Dr GREVILLE, seconded by ROBERT CHAMBERS, Esq., the thanks of the Society was unanimously given to Professor Fleming for his address.

II. *Notice of the Leaf Insect (Phyllium Scythe), lately bred in the Royal Botanic Garden of Edinburgh, with Remarks on its Metamorphoses and Growth.* By ANDREW MURRAY, Esq., W.S., Edinburgh. (Plates II., III., IV.)

The Royal Botanic Garden of Edinburgh has, during the past summer, possessed an attraction which has drawn great numbers of visitors.

A living specimen of one of the species of leaf-insect has, for nearly eighteen months, been an inmate of the hothouses ; and the curiosity of the public to see this interesting animal had latterly become so engrossing, that Mr M'Nab, the curator of the Gardens, to whose care and judicious management the prolonged life of the insect is entirely due, found it necessary, for the health of the insect itself, to forbid its being shown on more than four days in the week.

For the greatest period of its life, it so exactly resembled the leaf on which it fed, that when visitors were shown it, they usually, after looking carefully over the plant for a minute or two, declared that they could see no insect. It had then to be more minutely pointed out to them ; and although seeing is notoriously said to be believing, it looked so absolutely the same as the leaves among which it rested, that this test rarely satisfied them, and nothing would convince them that there was a real live insect there, but the test of touch. It had to be stirred up to make it move, or still more commonly was taken off the plant, and made to crawl on the finger of the attendant ; and the excitement of this constant stirring up and

handling was found to be so much the reverse of beneficial to the animal, that the above restriction on its days of receiving company was found indispensable.

The public owe the gratification of seeing this curious insect in its living state, to the amiable and accomplished wife of Major Blackwood, of the H.E.I.C.S., a name better known in Edinburgh in connection with "Maga."

It was she who, having been struck and delighted with what she saw of its economy in its native country, made successive attempts to introduce it alive into Britain, the third of which attempts was finally successful, in the case of the subject of the present memoir, a memoir which it has been thought might be interesting, as these insects have not only never before been seen alive in this country, but have never been bred, nor had their transformations watched by any naturalist.

The genus has been long known through a species named by Latreille and succeeding naturalists, *Phyllium siccifolium*; but the species properly entitled to this name, is still uncertain, it having been at first supposed, that there was only one species, and every specimen of a *Phyllium* having been referred to it. This confusion has been somewhat cleared up by Mr George R. Gray, who, availing himself of the rich collection in the British Museum, published a Monograph of the genus, in the first volume of the *Zoologist*, in which he described thirteen species, nine of which were new. The genus seems peculiar to the Eastern world; three of the thirteen having come from the Philippine Islands, three from the East Indies and Ceylon, one from Java, one from Mauritius, and one from the Seychelle Islands. The locality of the remaining four species, (among which is the old *Ph. siccifolium*) is unknown. The species with which we have to do, was described by Gray, under the name of *Ph. Scythe*, but without giving a figure of it, a want which we have endeavoured to supply. It comes from Silhet, and the mountainous district of India adjoining Assam. Specimens of the female not unfrequently occur in the cases of insects sent from thence, but the male comes much more rarely.

Mrs Blackwood found both males and females, as well as the young insect in all stages, plentiful in the valleys below Cherrapoonjie in the Kasiah Hills, which form part of the southern

boundary of the valley of Assam. A guava tree grew in the garden in front of her house, and on this she placed such specimens as she could secure, and when once placed on the tree they did not in general seek to leave it, at least until they assumed the perfect state, a convenient habit of which Mr M'Nab found the advantage in rearing his specimen. On returning to this country Mrs Blackwood endeavoured to bring some living specimens with her, but having found the trouble and attention they required too great, she, after bringing them safely to Calcutta, entrusted them to a friend, who shortly followed and brought them in good condition overland till they reached the Mediterranean Sea, when they died,—even that genial climate apparently not having suited them.

Mrs Blackwood next tried to introduce them by eggs. She got a parcel of eggs transmitted to her by post, but as they had not come out at the period she expected, she left them behind on going out of town (despaired of as regards hatching, but preserved as specimens), when to her mingled pleasure and regret on her return, she found that many of them had come out and died in the box in which she left them. Encouraged by this result, she again got a supply of eggs in the spring of 1854, and keeping a more careful watch upon them, she had the pleasure to find a pair come out on the 9th and 10th May: one or two followed every week till the end of May, when a week or so of cold weather occurred, during which no more came out; but when fine weather again returned in the beginning of June, they again began to come out in greater numbers. It was one or two of these which were entrusted to Mr M'Nab, and he succeeded in rearing to perfection the specimen which became such a favourite. He carefully noted down the periods of change in the insect, and such other circumstances regarding its habits as struck him, and he has been kind enough to furnish me with a note of these which I have embodied in the following paper.

On the young insects being hatched considerable difficulty was felt about their food. Of course the first thing thought of was the guava, and leaves of it as well as of various other allied *Myrtaceæ* were tendered them, but whether it was that the leaves having been plucked, and not growing on their stalk, did not suit them, or that some little time after their *eclo-*

sure must elapse before they begin to feed, they would not settle to any of the delicacies that had been provided for them, and fears about their starving began to intrude themselves.

The first plant tried was a Fuchsia, but it was afterwards abandoned for the common myrtle, and this seemed to suit them well. Mr M'Nab's specimen never sought to leave the plant on which it was placed till it was full grown and furnished with wings, when it was found necessary to put a muslin bell-shaped cover over the plant, to prevent the insect flying away.

The temperature of the house in which it was kept was as nearly 55° as could be maintained.

I have been thus particular in mentioning the details of their introduction, in order to aid, by our past experience, others who may in like manner attempt to breed them, because, from the interest which the present specimen excited, it is highly probable that such attempts will be made; and I should not be at all surprised if, in the course of a few years, the leaf insect should be as common an inmate of our conservatories, as the canary bird now is of our dwellings.

Having said this much as to their introduction, let us now turn to the insect itself, and take some note of its personal appearance and economy. We shall begin with the egg.

The egg is about the size of a small pea, barrel-shaped, and with six longitudinal ribs; it looks uncommonly like some seeds. As Mr M'Nab remarks, if the edges of the seed of the *Mirabilis Jalapa* were rubbed off, the seed might be mistaken for the egg. The ribs are all placed at equal distances except two which are wider apart, and the space between them flatter, so that on the egg falling it rolls over till it comes to this flatter side and there lies. The outside is rough and corrugated like the bark of a tree, and is penetrated by rows of largish longitudinal holes on each side of the ribs, and by rows of smaller holes between them. At the top there is a little conical lid fitting very tightly to the mouth. On the outside the lid is composed of the same bark-like structure as the outside of the body of the egg, and has its base surrounded by frill-like projections, which at first sight one might take for an apparatus for holding on the lid, but closer inspection shows

they belong to the lid itself. On removing the lid we see a beautiful porcelain chamber of a pale French white colour, bearing a close resemblance to the texture of a hen's egg, but it is not calcareous, and has more the appearance of enamel. On holding this shell between us and the light, we see light spaces where the holes in the cortical outer covering terminate, and in the centre of each there is a darker space, as if it were a pore ; but this conjecture I have not been able to verify. The substance composing the outer cortical covering is very curious. It is very thick. Looked at with the naked eye it seems of a spongy, reticulated, fibrous structure. But under the microscope we see that it is composed of cells, generally arranged in rows radiating outwards ; some irregularly shaped, but most of them with a greater or less tendency to a pentagonal or hexagonal shape. In fact, in some parts both the substance and structure bear a most striking resemblance to a piece of honeycomb.

It seems not difficult to conjecture the purpose which the cellular texture of this outer covering serves. If it had been of a firm close substance, the embryo insect could not have received the amount of air and moisture necessary for its existence, and which, from what I shall presently detail, are more than usually necessary in this family of insects.

Having received from Mrs Blackwood one or two unhatched eggs, and the shells of others which had been hatched, I was enabled to make an examination of the interior. On breaking into the egg which had been hatched I found two pellucid membranes, one within the other, the outer one doubtless corresponding to the chorion. On breaking open an addle egg, I found first a pellucid membrane (the chorion), and within it a clear carmine-coloured capsule, flask-shaped at bottom, but flat at the top.

This capsule might at first be taken for the dried-up yolk of the egg ; but if our readers will give me their forbearance, I trust to satisfy them that it is something very different. In order to do so, I must take them a little way back into the elements of entomology. They are doubtless aware that the *Orthoptera* (to which order of insects the *Phyllum* belongs) are characterized by what is called a semi-complete

metamorphosis, that is, that they quit the egg, not in the shape of caterpillars, but as six-legged insects, nearly similar in form to the perfect insect, but without wings, and, as will be afterwards shown, with some other parts only partially developed ; that after so appearing they at no time go into a dormant chrysalid state, but, after casting their skin a certain number of times, the wings and other perfect forms of the parts of the insect make their appearance. The first stage of these insects after their appearance out of the egg has been treated by entomologists as a peculiar form of the larva state, which Westwood has characterized as "homomorphous," or "monomorphous," from its resemblance to the perfect insect after its first moultings ; and when the wings begin to appear it was said to pass into the pupa state, and was called an active nymph, or pupa. Professor Owen, however, has pointed out that we ought not to look upon these "homomorphous" larvæ as true larvæ, but that the true larval condition is to be sought for in the egg. He states that "these insects" (the orthopterous and hemipterous) "are at one stage of their development apodal and acephalous larvæ, like the maggot of the fly ; but instead of quitting the egg in this stage, they are quickly transformed into another, in which the head and rudimental thoracic feet are developed to the degree which characterizes the hexapod larvæ of the *Carabi* and *Petalocera* ; the thorax is next defined, and the parts or appendages of the head are formed, at which stage of development the young orthopteran corresponds with the hexapod antenniferous larva of the *Meloe* ; but it differs from all coleopterous larvæ in being inactive, and continuing in the egg almost until all the proportions and characters of the mature insect are acquired, save the wings."*

This philosophic view was, I believe, first enunciated by Owen. At any rate it has received his approval, and, I may add, the sanction derived from his personal observation ; for in an after-passage on the same subject, and which I have pleasure in quoting for more reasons than one, he says, "Metropolitan duties shut out much of the field of nature ; but still she may be found and studied everywhere. I first learned to

* Lectures on Invertebrate Animals, Ed. 1855, p. 424.

appreciate the true nature and relations of the nominally various and distinct metamorphoses of insects, by watching and pondering over the development of a cockroach (also an orthopterous insect), which quits the egg as a crustacean. I saw that it passed through stages answering to those at which other insects were arrested: there was a period when its jointed legs were simple, short, unarticulated buds,—when its thirteen segments were distinct and equal,—when it was apodal,—when it was acephalous.”* This statement, I think, not only entitles, but obliges us to hold, that it has been determined by observation that the larva of orthopterous insects has been detected in the shape of a maggot passing the early portion of its life in the egg.†

Having arrived thus far, I was surprised to find Professor Owen stopping here. I thought the necessary consequence of assuming that the early stage of the orthopteran was a caterpillar in the egg, was, that it also passed the chrysalid state in the egg. I could quite understand the perfect jointed insect being eliminated at once out of the embryonic elements in the egg, in the same way that a chicken is hatched; but if the maggot is once hatched instead of the chicken, I know of no means, or no analogy, by which its vermiform character can be

* Lectures on Invertebrate Animals, Ed. 1855, p. 437.

† I am inclined to think that all insects pass a more or less considerable portion of their larval state in the egg. Except on this assumption, I am at a loss to account for the well-known fact of the exclusion of ichneumon flies from the eggs of various insects, for I find difficulty in accepting the proposition that these parasitic larvæ feed on the yolk of the egg. The whole economy of the ichneumon seems to me opposed to this. All those which we can watch require a living animated organism on which to feed; and although the yolk might, for a short period, retain its vital powers even after it has begun to be preyed upon by the ichneumon, I apprehend such a period could only be brief. The yolk would soon have its vitality destroyed by the intrusion of the parasite, which would perish along with the decaying mass which its presence had corrupted. It seems more consistent with their habits and economy, to suppose that those minute parasites feed upon the larva already formed in the egg, or, at the utmost, that they commence their ravages after the development of the yolk into the larva has commenced, and reach their chrysalid state as the yolk by its dying effort completes the larva, in the same way as the larger ichneumons devour the excluded larvæ, mining away their powers till they leave them only strength to pass into the chrysalid state simultaneously with themselves.

changed, except by passing through the dormant chrysalid state. To make this plainer to non-entomological readers, I should observe, that the process by which the caterpillar, in passing through the chrysalid state, is changed into the perfect insect, is not, as Kirby and Spence supposed, by all the subsequent forms being originally included under the skin of the larva, and that every successive operation was merely casting off an old coat, to appear, like the riders in a circus, in another one under it; but the process, as shown by the accurate observations of Herold on the changes and development of the organs during the pupa state, is, "like the original processes of the development of the larva itself, the results of a transmutation, increase, and coalescence of primitive elements of the different tissues,—elements which consist of nucleated cells or nuclei, like those that result from the spontaneous fissions of the primary impregnated germ-cell,—elements which may be viewed as parts of the original germ-mass, retained to be successively metamorphosed into the successive larval skins, pupa skins, and imago."*

To give a more familiar illustration of this transmutation, &c., I may adduce an experiment familiar to most entomologists. Take a newly-formed chrysalis, break it in two, and we find the muscular fibre, &c., not much changed from that of the larva. Take it somewhat older, and break it, we find it full of a liquid like milk. The old fibre has been disintegrated before it can be made into the new form. Break a chrysalis at a more advanced period, and we find no longer this milky substance, but the form, figure, and organs of the perfect insect already stamped, and ready to appear at the proper season. It is like a paper manufactory,—the new paper cannot be made until the old rags are reduced into a pulp.

This transformation through the chrysalis, then, being the sole analogy which we have to argue from, I cannot conceive how we can evade the necessity of the egg-larva of the orthopteran also passing through a dormant chrysalid state, in which the disintegration and transmutation of the larva may take place. But if the jointed-legged insect be the pupa or

* Owen's Lectures on the Comparative Anatomy of Invertebrate Animals, p. 434, Edition 1855.

chrysalis, we have no such period during which the dissolution and transmutation of the insect may take place. It cannot have its fibres and muscles dissolved into a homogeneous mass while it is actively walking about, as if nothing was the matter with its muscles ; and we must have recourse to some new machinery not yet known in insect life, to account for such a state of things. Such being the case, I expected that Professor Owen would have taken the view, that the chrysalid state, as well as the larval state, was passed in the egg ; but he does not do so. The nearest approach he makes to it is when he says, “ The metamorphoses which the locust undergoes in its progress from the potential germ to the actual winged and procreative imago, are nevertheless as numerous and extreme as those of the butterfly. The differences are relative, not essential ; they relate to the place in, and the time during which the metamorphoses occur, and to the powers associated with particular transitory forms of the insect. The legs of the worm-like embryo-locust were once unarticulated buds, like the prolegs of the caterpillar ; but the creature was passive, and development was not superseded for a moment by mere growth ; these organizing processes go on simultaneously ; or rather change of form is more conspicuous than increase of bulk. The six rudimental feet are put to no use, but constitute mere stages in the rapid formation of the normal segments, which attain their mature proportions, and their armature of claws and spines, before the egg is left. The first segment of the original apodal and acephalous larva, is as rapidly and uninterruptedly metamorphosed into the mandibulate and antennate head, with large compound eyes.”*

Now, although it is impossible to doubt, that the idea of the larva changing into a chrysalis in the egg, and there completing its transformation, must have crossed the mind of Professor Owen,—still, whether it be from thinking that his own observations did not justify him in promulgating such an opinion, or from whatever other cause, it appears clear that the above-quoted passage does not announce such a doctrine, and indeed the latter part would seem to contradict it, and to lead to the inference, that he considered the six-legged insect which emerges

* Owen’s Comp. Anat., p. 436.

from the egg, to be "uninterruptedly metamorphosed" from the larva in the egg; and other passages and expressions, when speaking of the emerged insect before it acquires wings, show sufficiently that he looks upon that state as the pupa or nymph state. For instance, he says, "The active *pupa* of Orthoptera and Hemiptera are called 'nymphs.'" Again, speaking of the moulting of these so-called pupa or nymphs, he says: "When this active pupa or nymph again moults, the insect attains its perfect condition." And afterwards he adds: "Here then we see that the pupa stage, which in the butterfly was passive and embryonic, in the locust, is active and voracious; whilst their respective conditions in the larval state are reversed. The whole period of the life of the Orthopterous insect," he goes on, "from exclusion to flight, may, if its organization during that period be contrasted with that of the Lepidopterous or Coleopterous insects, be called an active nymph-hood."*

The extracts which I have given on the authority of Professor Owen, are quoted from the last edition of his Lectures on the Comparative Anatomy of Invertebrate Animals, published in May 1855; and I am taking it for granted, that we may assume them to contain the latest recognised views of physiologists on the subject. We see, then, that the present opinion is, that the orthopterans pass the larval phase of their existence in the egg,—that they pass their pupa state in an active six-legged, but unwinged form, after coming out of the egg,—and that the perfect insect is only seen when the wings are developed.

Now, the proposition which I venture to submit after careful consideration of what I have observed of this leaf-insect, is, that both the larval and chrysalid states are passed in the egg, and that what has been called the homomorphous larva or the active pupa, is merely a phase of the perfect insect. The analogy on which I have just remarked speaks strongly in behalf of this view. The examination of the capsule found in the egg confirms it. This capsule has a distinct determinate form. It is covered with a pellucid membrane of its own, as can be seen in another specimen where

* Owen's Comp. Anat., p. 436.

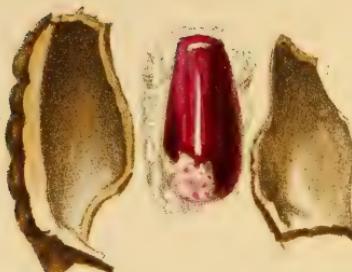
Fig. 1.
Egg Nat. Size.Fig. 2.
Egg Nat. Size.Fig. 3.
Do. Magnified.Fig. 4.
Do. Magnified.

Fig. 7.

Fig. 5.
Nat. Size.
YOUNG ON
EMERGING FROM EGGFig. 6.
Do. Magnified 2'.

FEM ANT.

Fig. 8.

ANT. OF MALE
AT FIRST MOULT

Fig. 9.

ANT. OF MALE
AT LAST MOULT

Fig. 10.)

Magnified 4'.
PHYLLIUM SCYTHE.
(DETAILS)

the insect has passed out of the capsule and out of the egg, and where both the outer chorion and the skin of the capsule may be seen one within the other. These circumstances imply that the capsule is not a yolk; because if it had been a yolk surrounded by albumen within the chorion which had dried up, it would not have preserved a determinate form, and it would not have had a membrane round the capsule (quasi-yolk). A yolk has not a membrane round it like the chorion round the albumen; and the yolk or interior of the egg in drying up does not assume a determinate form. Farther, in the eggs of insects which emerge from the egg in the larva state, there is only found one membrane (the chorion), the same as in a hen's egg. I refer to a specimen of the egg of one of the largest coleopterous insects known (the longicorn, *Titanus giganteus*), where it will be seen that there is only a single membrane or chorion surrounding a dried amorphous mass. This capsule, then, not being the yolk or original contents of the egg, we are driven to look for some other explanation of its form and appearance; and these considerations tending to confirm the view suggested by the analogies of the subject, I do not hesitate to submit as an explanation, that the capsule in question is the chrysalis of the leaf-insect, and that the same physiological arrangement will be found in all orthopterous and hemipterous insects.

It cannot be urged as an argument against this view, that what I consider the perfect insect changes its skin a certain number of times. The larva changes its skin; and nobody thinks that on that account it has ceased to be a larva. The perfect crab changes its skin; and we still look upon it as perfect as before. That specialty, therefore, has no relevance. A more embarrassing fact is, that after emerging from the egg, changes take place on the form of the insect, and important organs are altered or appear. As I shall presently mention, an important alteration takes place in the antennæ; and large wings, which are wanting on the first appearance of the insect out of the egg, finally emerge. But it is to be observed that all these changes take place in the way of gradual growth, something like the appearance of teeth in the mammal. The wings begin to bud out of the back after the first

change of skin; they are small short wings after the second change, and expand into their full size after the third and last. In the same way the alteration in the proportions and in the antennæ are gradual and progressive, and may be traced as the animal moults. Another circumstance which I must not overlook, although at first sight it seems to make against me, is, that in the young insect (that is, the insect excluded from the egg but not yet furnished with wings), the male and female sexual organs are not developed, or at least not fully developed; while in insects passing through what is called a perfect metamorphosis, they are as fully developed on emerging from the chrysalis as ever they are. But I would only class this with the other instances of growth, and rather use the analogy of the changes in our own species on attaining to puberty, to show that it is not an essential ingredient in metamorphic changes. Such changes are obviously not only of much less importance, but also of a totally different class of physiological development, than the change effected in the dormant chrysalis, and, it appears to me, are to be looked at as instances of growth in the perfect insect, not as a mode of metamorphosis at all.

In leaving this part of the subject, I have only farther to say, that I am quite alive to the meagreness of the observations on which I have ventured to build this hypothesis, and that my premises might have been more extended. Had I had more eggs, and had the opportunity of opening them at different periods, my premises *would* have been more extended. But as long as there was the chance of a leaf-insect being hatched from the eggs, they were too valuable to be broken. I have only examined one addle egg, and it chanced to be one with what I suppose to be the chrysalis in it. Some more fortunate individual will, I hope, ere long have the opportunity of settling the question; and if, on opening eggs at an early period, he find a maggot, and at later periods this capsule, I think I shall then be entitled to say that it has been settled in my favour.

But to proceed with the history of the insect. After having reached the form of a six-legged jointed insect, it emerges from the egg by pushing off the lid. It comes out middle

foremost, that is, its head and tail are packed downwards, so as to meet each other; the back between them first appears, and they are drawn out next; the legs are extricated last. The colour of the insect at this stage is a reddish-yellow, something of the hue of a half-dried beech leaf; for it is to be observed, that although the colour of the insect varies at different periods of its life, it always more or less resembles a leaf in some stages. When it has once settled to eat the leaves on which it is placed, the body speedily becomes bright green. Among the leaves of the common myrtle it cannot be distinguished by the colour of the body (the legs are browner); and its habit of carrying itself tends to add to the deception. It bears its tail generally curled up a little, just about as much bent as the myrtle leaf. As it bends its tail up, however, the curl would be the wrong way, unless the insect walked back downmost, which, in point of fact, is its constant habit, adhering to the under side of the leaves. This habit brings to light another beautiful contrivance for still farther heightening its resemblance to a leaf. The upper surface is opaque green, the under surface glossy, glittering green, just the reverse of the myrtle or guava leaf; so that, by reversing its position, it brings the glossy side up and the dull side down.* It is provided with tarsi to suit this upside-down mode of life. Between each of the claws there is a large spongy pad, which, as with flies walking on the ceiling, enables it to adhere firmly to the leaf; indeed it was always difficult to disengage its hold of anything it stuck to.

There are several differences between the form of the insect at this stage and as it finally appears. It has no wings now. The antennæ, whether the animal subsequently turn out to be male or female, have at present the form of the antennæ of the perfect female. On the other hand, the legs have the male form. The flat leaf-like appendages to the legs of the female are much broader and more expanded than those of the male; and as every example of the freshly-eclosed insect which I have seen has these appendages shaped like those of the male (while at the same

* This peculiarity is much more distinctly seen in the young state and living insect, than in the dried specimens.

time the antennæ bear the female stamp), I assume that this is the normal character at this period. The form of the segments of the abdomen are somewhat different. They taper to the tail from the third segment, instead of running parallel to each other, or nearly so, throughout the fourth, fifth, and sixth segments. There exist the same number of segments in the abdomen, and also of parts in the thorax; but when the wings afterwards appear, there is, of course, some difference. In some specimens I think I can see a swelling where the joint of the wing is to emerge; and there is a pinching up of the skin where the scutellum afterwards appears, for it is wanting in the young insect, though present in the full-grown one. As already mentioned, the sexual organs are not developed in the young specimen.

The leaf-insect is subject to three moults, as is generally the case with the Orthoptera. The insect reared by Mr M'Nab was hatched in the beginning of June 1854. Its first moult took place about ten months afterwards, viz., on 10th April 1855. During that time it had increased very gradually but not greatly in size. It was not an inch in length when hatched, and at its first moult it measured not much more than an inch. On this moult taking place, the change in its form and proportions was very trifling. The abdomen became relatively broader, and the swelling at the part where the wings afterwards burst out more decided. The most interesting change, however, was observed on the antennæ; and, as the circumstance has not hitherto been noticed, it is worthy of attention. A reference to the figure of the female antennæ will show that they are short and thick (scarcely one-eighth of an inch in length), and composed of nine joints, the third of which is considerably thicker, longer, and more bulky than the rest. On the other hand, the antennæ of the male are long and thin, about one and a quarter inch in length, and composed of twenty-four joints, and the third joint at the base is not thicker or larger than the rest; on the contrary, the joints get shorter and shorter as they approach the base, and the basal thirteen are decidedly smaller, and of a different form from the apical eleven. But the antennæ of all the young freshly-eclosed insects

(whether male or female) are short like the female, and consist only of nine joints. They are perfect miniature representations of the full-grown female antennæ. After the first moult, however, a change was perceptible on the antennæ of the specimen bred; and that change can still be distinctly seen in the cast skin, which has been kept. The third joint has grown longer. No trace of division can yet be seen in it, but if we had the next skin (which we unfortunately want), I feel certain we should find traces of divisions in the joints. We have, however, the third and last skin which was moulted, and we see in it that a great change has taken place. The antennæ still bear the general short, thick, female form. They are only a little longer; but on counting the joints, we find that there are now eleven joints beyond the third, where before there were only six, as if each had been split in two except the terminal joint, and we find the third joint to contain within itself eleven more new ones. It has become elongated, and a series of striæ (they can scarcely yet be called joints) run across it, well defined on the interior side, but not so well defined on the exterior margin. These with the two basal joints, on which no change has taken place, make up the twenty-four joints of the male antennæ; and on the insect emerging from the last skin, they rapidly extend themselves to the full-grown size. I may observe, that the multiplication of parts by subdivision (although a mode often adopted by nature in other classes of living animals) is not the usual course followed in the case of insects; for instance, the *Iulus terrestris* (which may be taken as a type of the Myriapods) has, when it emerges from the egg, only eight segments. These are multiplied by the growth of new segments—six at a time; but the new segments are not formed by a division of the old, but by generation from the penultimate segment at the terminal space. The interesting skins preserved, in this instance, leave no doubt as to the means by which the segments of the antennæ have been increased.

As I have already mentioned, however, we have not the second skin; the insect ate it up before it could be secured. I am not aware whether this singular act of cannibalism has

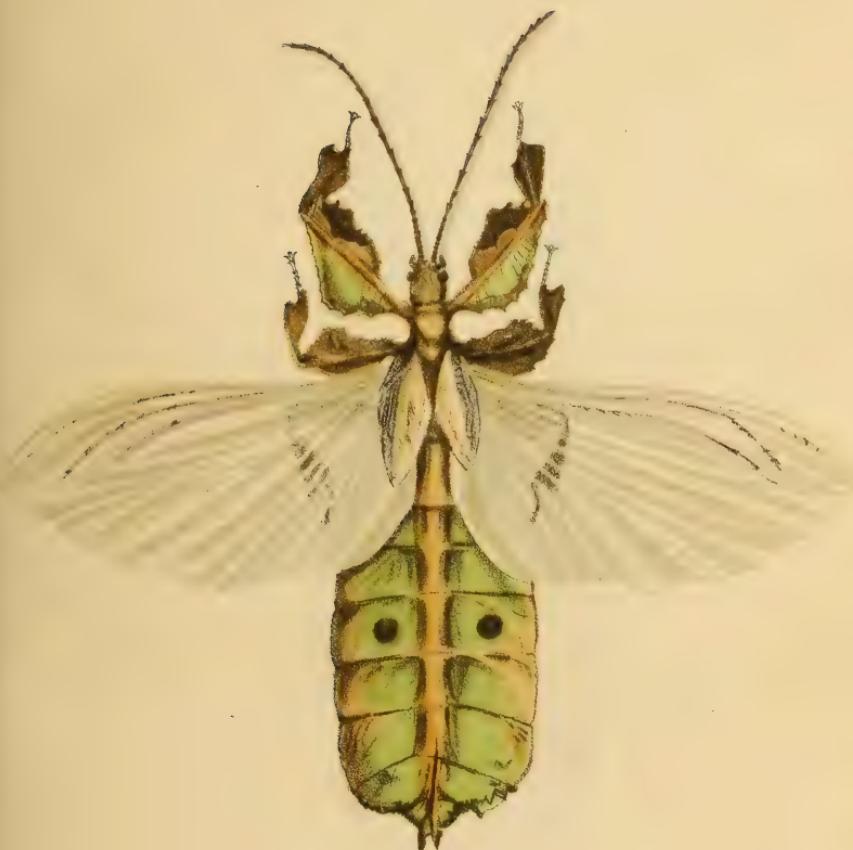
been observed in other insects after moulting. But Mr Thomas Bell, in his History of British Reptiles, records a similar instance in the toad. After describing the process of divesting itself of its skin, which he had watched in the common toad, he says,—“The whole cuticle was thus detached, and was now pushed by the two hands into the mouth in a little ball, and swallowed at a single gulp.” But although it would seem to indicate a very morbid appetite in the toad, this piece of epicureanism does not strike us as so extraordinary in it, as it does in the leaf-insect. The toad lives on animal food; but this insect whose food is exclusively vegetable, has surely made a curious deviation from its instincts, unless we are to hold that the leaf-insect not only looks like a leaf, but also tastes like a leaf.

The second ecdysis or moult took place on the 16th of July, at 8 A.M.; indeed they all took place about that time of the day,—the first having been at 10 A.M., the second at 8 A.M., and the third at 9 A.M. After the second, the tegmina and wings made their appearance, but of small size. The third moult was on the 17th September, when the full-grown wings and antennæ were produced. The day previous to the casting of the skin, the insect was observed to be unusually lively, shaking and working about with its body, while the feet seemed firmly attached to the leaf. Before the moultings the insect became of a grayish tinge, doubtless caused by the skin having become loose, through the shaking process alluded to.

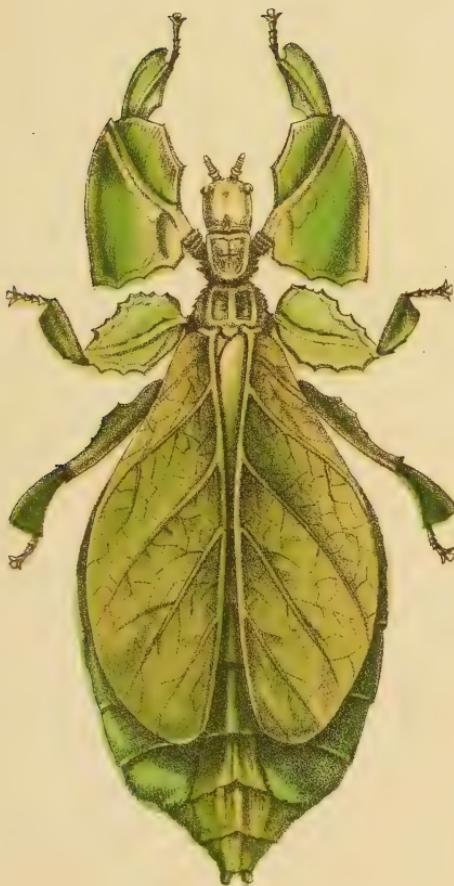
Its rapid increase in size after emerging from the old skin is most remarkable. An accurate observer in the East writing to Mrs Blackwood of the moulting of the locust, gives so graphic an account of it, and one so exactly describing the process that took place in our leaf-insect, that I cannot refrain from quoting it. He says—“The most extraordinary circumstance attending the process is the rapid or almost instantaneous growth of the animal as he emerges from his old covering, each limb on being freed being about a fourth longer and larger than the corresponding part of the case from which it has just been withdrawn. The wings you can see shoot out

PLATE III.

Royal Physical Society, Edinburgh.



PHYLLOM SCYTHE.
(MALE)



PHYLLOM SCYTHE
(FEMALE)

to their full length ; they also come out of little cases of about a quarter of an inch long, and in the course of a few minutes attain their full growth of about two and a half inches long. The whole process does not take more than ten minutes. The animal now in its perfect form is at first very soft and tender, but in the course of half an hour's exposure to the atmosphere, he hardens and becomes strong and ready for flight." One would say that this description had been written for the leaf-insect,—so exactly does it represent the process in it.

After each of the first two moultings, the insect assumed a beautiful emerald-green colour ; while after the last moult, the body had a slight tinge of yellow round it. It subsequently gradually became yellower and brownish at the edge, passing through the different hues of a decaying leaf. Like the leaf it resembles and feeds upon, it seemed to decay on arriving at maturity ; and it is to be observed that its sere and yellow leaf also occurred at the period of the year when the foliage assumes its autumnal tint, viz., in the end of September and beginning of October. How far the causes which bring about this result resemble each other in plants and animals, will be an interesting subject of inquiry to the physiologist, when we have a better supply of the insect to experiment upon.

III. *On a Remarkable Pouched Condition of the Glandulae Peyerianæ of the Giraffe.* By T. SPENCER COBBOLD, M.D., Assistant Conservator of the Anatomical Museum, University of Edinburgh. (Plate V.)

Among the various modes of extension of the intestinal mucous element in vertebrate animals, we have several instances where the general absorbing surface is increased by the development of sacculi or pouches ; but, so far as we are aware, no example has hitherto been placed on record of a similar kind of membranous reduplication specially involving Peyer's patches.

At a meeting of the Physical Society, held April 5, 1854, we offered a somewhat detailed account of the anatomical and pathological data furnished by the post-mortem examination of a Giraffe, and the facts then enunciated (except as regards the

morbid changes) served merely to confirm a few of the numerous particulars which had been previously described in the admirable monographs of Professor Owen.*

After the lapse of more than a twelvemonth, we had occasion to overhaul the *parts* laid aside for future conservation and permanent display in the anatomical museum, and on carefully re-examining these, we detected at the root of the cæcum, and in portions of the small intestine, the peculiarities to be immediately noticed. The circumstance of their having hitherto escaped observation is easily accounted for, inasmuch as the sacculi, in the present case, were only rendered visible by repeated washings, and the removal of a thick layer of tenacious mucus which completely obliterated all trace of the foldings. During our temporary absence from the meeting of the British Association recently held at Glasgow, the preparations now before the Society were exhibited by Professor Allen Thomson to the Physiological Sub-section of that assembly, and since then we have had an opportunity of privately calling the attention of Professor Kölliker of Wurtzburg to the subject; we feel confidence in stating, therefore, that the occurrence of the sacculi in question is certainly quite unusual, if not altogether absent in other mammalia.

In the first place, we observe that only a proportion of the composite glands proper to the small intestine presented any deviation from the ordinary type, and in consequence of our having retained only a few small sections of the tube detached indiscriminately from different parts of the gut, we were unable to form even an approximate notion as to the actual number of patches showing the following modification. Out of the eight or nine *glandulæ* examined by us, four of the masses, varying severally from half an inch to three inches in length, exhibited at their anterior or duodenal extremity a semilunar valve-like fold of mucous membrane. Each fold forms a sort of cul-de-sac, which in the two larger patches is capable of admitting the tip of the little finger; the exposed or convex surface exhibits the ordinary villous texture of the intestine,

* On the Anatomy of the Nubian Giraffe, in Zool. Soc. Trans., vol. ii.; also a second Memoir in vol. iii., for 1838-1839.

while the concave or inner aspect of the valve is, on the contrary, follicular.

It is to the last Peyerian patch that we wish to direct especial attention ; for here we have developed an extremely complicated structure, consisting of from fifteen to twenty pouches, the whole forming a network of cells, and reminding us to a certain extent, of the water cavities of the *reticulum*. This large compound gland stretches itself continuously from a point anterior to the extremity of the small intestine, to rather more than two inches beyond the ileo-colic valve ; and it is from the latter division of the patch that the anomaly (which is represented in the accompanying plate) proceeds. Seven of the pouches are complete, and bounded by extremely attenuated *lamellæ* projecting from two to four lines beyond the surface ; they are more or less polygonal, the openings of the first five being large (Nos. 1, 2, 3, 4, 5), and nearly as broad as the calibre of the cavities internally ; the other two (6 and 7) have contracted oval orifices, measuring only about half the width of the pouches, within. From the right wall of the cavity, marked No. 1, part of the tissues were removed, and subjected to microscopic examination, when the glandular substance showed appearances such as are ordinarily recognised in the agminated follicles, while beneath the submucous tissue muscular fibres were found, of the non-voluntary kind. Some of the cavities contain secondary sacculi, but these are generally small, and separated by very slightly developed septa ; at the upper part of the sacculus, figured No. 5, is seen one of the secondary pouches of a triangular form, and well defined. The eighth, ninth, tenth, and eleventh spaces are represented by mere depressions bounded by rudimentary partitions scarcely raised from the surface ; the twelfth, thirteenth, and fourteenth are more decidedly saccular, especially the first-named, which is elongated, and shows traces of subdivision. Thus far all the folds are lined within and without by follicles characteristic of the compound intestinal glands ; the latter structures are fully developed at every part, but acquire greater conspicuity as they ascend the colon, in which situation they are less closely packed together, and of larger dimensions. Finally, it only

remains for us to refer to six additional sacculi, which are more or less incomplete, and present scarcely any trace of the follicular element; two of them (15 and 16) are shallow, two rather deep (17 and 18), and two (19 and 20) comparatively insignificant.

IV. Notice of the Occurrence of Meteoric Lead in Meteoric Iron from Tarapaca, Chili. (Specimen exhibited.) By M. FORSTER HEDDLE, M.D.

A description of this iron, with analyses and a notice of the occurrence of *Lead* in its cavities, having been inserted in the July Number of the Philosophical Journal, I have, on the present occasion, little left me except to exhibit the specimen.

Mr Greg having observed globules of a bluish metal filling up small nests in the iron, sent them to me for examination; and it was a singularly interesting circumstance that Professor Shepherd, of America, who has devoted so much attention to meteoric bodies, was inspecting my collection when the chips of metal reached me, and witnessed the preliminary investigation which introduced lead as one of the elements of those mysterious bodies which visit us from parts unknown.

By as careful and complete an analysis as the small quantity of metal at my disposal enabled me to institute, I was able to detect no substance in these chips but metallic lead. When these portions of the globules which had been in contact with the iron were examined, small quantities of iron and alumina, with traces of magnesia and phosphorus were likewise found.

Two supposed new mineral substances which occur in this iron are in my hands for examination; the analyses of these when completed I will lay before the Society.

Slices of the iron which contains this meteoric lead have the high value which is always attached to unique specimens; and it is satisfactory to know that, through the generosity of Mr Greg, one of the slices is now in the College Museum.

Alexander M. Edwards, Esq., 33 Northumberland Street; Robert Chambers jun., Esq., 1 Doune Terrace; and James Hector, Esq., 57 Inverleith Row, were balloted for, and elected members of the Society.



POUCHED PEYERIAN GLAND
(G. PEYERI)
(CAMELOPARDALIS CIRAFFA)

Wednesday, December 26. ROBERT KAYE GREVILLE, Esq., LL.D.,
in the Chair.

The Donations to the Library were laid on the table, and the thanks of the Society voted to the donors. These included :—1. Footmarks in the Red Sandstone of Pottsville, Pennsylvania, by Isaac Lea. 2. On a Fossil Saurian of the New Red Sandstone Formation of Pennsylvania, with some account of that Formation. Also, On some New Fossil Molluscs in the Carboniferous Slates of the Anthracite Seams of the Wilkesbarre Coal Formation, 1852, by Isaac Lea. 3. Notice of the Oolitic Formation in America, with Descriptions of some of its Organic Remains, by Isaac Lea. 4. Descriptions of Nineteen New Specimens of *Colimacea*, by I. Lea. 5. Description of a New Species of the Genus *Unio*, by I. Lea. 6. A Synopsis of the Family of *Naiades*, by Isaac Lea. 7. Rectification of Mr T. A. Conrad's "Synopsis of the Family of *Naiades* of North America," by Isaac Lea. 8. Meteorological Observations, Napa-Keang (Loo-Choo). 1848-49, made by Dr Bettelheim. 9. Catalogue of the Tertiary Testacea of the United States, by Henry C. Lea.

From Isaac Lea, Esq., sent through the Smithsonian Institution, U.S.A.

The following Communications were read :—

1. *Notices of the Saury Pike* (*Scomberesox Sauris*, Penn.), *taken in the Firth of Forth.* (Specimens were exhibited.)

Mr R. F. Logan referred to the immense influx of the Saury Pike, *Scomberesox Sauris*, which visited the Firth of Forth in the beginning of November. Many appeared about Musselburgh, and were carried by the fishwives in their creels into Edinburgh. For a considerable time, however, he found it impossible to obtain a perfect specimen at Duddingston, as they had most ingeniously cut off their long snouts with the view of deluding purchasers into the belief that they were young mackerel. One, however, more honest than the rest, brought them *au naturelle*. It seems an excessively delicate and easily-injured fish. He did not see one with the scales on; and all that were thrown up along the shore near Leith appeared more or less mutilated. With regard to its food, he had not been able to find any direct statement in our Ichthyological authors, but suspected it must consist of delicate marine *Annelides*, possibly of the genus *Nereis* and its allies, which the fish snaps across the body with its long beak, and swallows at its leisure. This, however, was mere conjecture, which he had not at present the means of verifying, but received some slight confirmation from a statement made by the most honest of the above-mentioned fishwives,—viz., that the fish were captured at Musselburgh and Fisherrow, by men and boys in the shallows *with unbaited hooks*. Now, unless they took them for some kind of annulose animal, it was difficult to understand why they should swallow hooks without a bait. The earliest notice of its occurrence in Scotland seemed to be that

of Pennant, who mentions that great numbers of these fish were thrown ashore at Leith after a storm in November 1768 ; and the Rev. Mr Low, in his " Natural History of Orkney," says, that in 1774, such a glut of them set into Kerston Bay that they could be taken by pailfuls, and heaps were flung ashore.

Dr J. A. Smith read an extract from the *Alloa Advertiser*, showing the extraordinary abundance of these fish ;—“ On the afternoon of Monday (29th October), but especially on Tuesday, and partially on Wednesday (31st), vast shoals of fish, of the genus *Scomberesox*, technically known by the name of Saury Pike, ascended the river Forth, and were gladly welcomed by the citizens of Alloa, more especially by the humbler classes of the community. The river Forth, betwixt Kincardine and Alloa, during the days above mentioned (particularly Tuesday), was literally swarming with these fish, and millions of them have from first to last been captured. Hundreds of people lined both banks of the river on successive days, and came away with bags, baskets, and boxes, laden with the herrings ; hundreds of young people, while wading along the margins of the river, picked up armsful of the fish ; parties cruizing about on the river gathered up the herrings as rapidly as they chose with their hands, from the sides of their small boats ; parties in Alloa, Kincardine, Kennet, Alva, Tillicoultry, and Stirling, obtained cart-loads of them, and sold them to ready purchasers ; and numbers of the fish were destroyed by the paddles of the Stirling steamers.” He believed they had been found generally along the coasts of the Firth ; the great body of fish, however, appeared at the upper part, which was narrow, and perhaps, from confining the shoals, brought them more distinctly under the notice and reach of the people. Those he examined had generally six finlets following the dorsal, and seven after the anal fin. The pectoral fins are small, and somewhat notched or forked at their extremities. The dorsal fins are dusky in colour, the pectorals lighter, with a white spot on each, and the ventrals and anals nearly white. Two curious keel-like edges commence on each side at the lower edge of gill coverts, and run about one-fourth of an inch apart, nearly the whole length of the body, terminating generally about three-fourths of an inch from the commencement of the tail. When cooked it was very good eating, not unlike the mackerel, and contained a considerable quantity of oil ; a fisherman informed him that he obtained a gill of beautifully pure oil from some four or five individuals. A. Whyte, Esq., Queensferry, sent him several specimens, and in a note, dated the 14th November, refers to them having entirely and suddenly disappeared a short time before. “ One old fisherman had known them for upwards of fifty years, but only once (about forty-five years ago) had he seen them in such quantities as this year. He believed the greatest numbers were taken along the shores ; some of them swam with part of their heads above the water, and in this position several were shot by the watchmaker here with his fowling-piece.” A few specimens were next taken about the 19th of November, and on the

22d a considerable number were caught in the herring-nets off Queensferry. These, of course, were very perfect, the beak not being injured, as it generally was in those found on the shore (and of these he exhibited a perfect specimen). The east or north-east wind was very prevalent before and during the first appearance of these fish; it then veered to the westward, and the fish disappeared; and, on its again changing to the east, we had their recurrence at the latter part of November, to which he had just alluded; after which they finally disappeared. Dr Parnell, apparently, had never met with them. *Vide* "Essay on the Fishes of the Forth," published in 1838.

2. *On the Galactite of Hardinger; with Analysis of Scottish Natrolites.*
By M. FORSTER HEDDLE, M.D.

After submitting six analyses of *Galactite* (from the following localities —two from Glenfarg, red and white; from Campsie; two from Bishoptown, white and pink; and from Glenarbuck), Dr Heddle showed that this substance was merely *Natrolite*; lime, in proportions from .16 up to 4.312, replacing a portion of the soda, giving to the mineral its characteristic whiteness and opacity, and doubtless preventing its assuming the definite form, which the pure mineral, under favourable circumstances, adopts.

Dr Heddle next submitted an analysis of a green mineral from Bowling Quarry, Cochney, and Bishoptown, which has been sold under the name of "*Stellite*," and which Professor R. D. Thomson considered *Pectolite*; this was shown to be also *Natrolite*; lime was here present, as also magnesia and oxide of iron as impurities.

The analysis of a specimen from Dumbarton Moor also showed 3.76 per cent. of lime, so that out of six localities, no specimen was free of this base.

The Bin above Burntisland and North Berwick were also mentioned as localities of this mineral; no analysis, however, of specimens from these places was submitted.

At Glenfarg alone in Scotland does this mineral occur distinctly crystallized, the form being *o m* of Brooke and Miller.

3. *Notice of a variety of Cod, termed the "Lord Fish."* By T. SPENCER COBBOLD, M.D.

This variety consisted in a remarkable shortening of the body, arising from the coalescence of a great number of the vertebræ immediately succeeding the bones of the head. In the present example, twenty-one were united together, and the shortening thus produced had given to the animal a curiously grotesque appearance. The middle dorsal fin was shortened, and the lateral longitudinal line arched very suddenly over the pectoral fins. Length, about 20 inches; depth, 8 inches. It corresponded very closely with the figure and description of this variety given in the second

edition of Yarrell's "British Fishes," vol. ii., p. 229. The notice was accompanied with a preparation of the spine, and a coloured wax cast representing the external characters.

Mr George Logan exhibited a drawing of a smaller specimen of the same variety, which he had obtained several years ago from the Firth of Forth.

4. *Notice of a Curious Habit of the Common Seal.* By Mr WILLIAM M'INTOSH. Communicated by T. SPENCER COBBOLD, M.D.

This communication, from an eye-witness, minutely described the manner in which the common seal caught and devoured its prey,—in this instance, a ballan wrasse, which the seal held in its fore-paws, and carefully denuded of its skin before devouring.

5. *Notice of the Ferruginous Duck, or White-Eyed Duck* (*Nyroca leucophthalmos*, Flem.), *recently shot near Musselburgh.* By JOHN ALEX. SMITH, M.D.—(The specimen was exhibited).

The bird, an adult male, measured $16\frac{3}{4}$ inches from the point of the bill to the tip of tail; and $27\frac{1}{2}$ inches in breadth from point to point of its extended wings. The first primary is the longest, others gradually decreasing in length. From flexure of wing to point of first primary, measures $7\frac{3}{4}$ inches; inside of wings and axillaries white. Its weight was 17 ounces. The trachea (which was exhibited) $5\frac{1}{2}$ inches long, is peculiar, the upper part being rather more than $\frac{1}{4}$ of an inch in diameter, gradually expanding to $\frac{1}{2}$ an inch, and again contracting to less than $\frac{1}{4}$ of an inch towards the lower part, where it terminates in a bony and membranous labyrinth about $1\frac{1}{2}$ inch in length (well figured in "Yarrell's British Birds.") The œsophagus was about $7\frac{3}{4}$ inches in length; the stomach, a strong and muscular gizzard, was filled with seeds of the oat, mixed with small pieces of quartz and gravel. The intestines from pylorus to anus were 3 ft. 9 in. in length; two cœca, one $4\frac{3}{4}$ in., the other $4\frac{1}{4}$ in. long, enter the gut about $2\frac{1}{2}$ inches from its lower extremity. The bird is an occasional winter visitant of England, but appears to have been very rarely seen in Scotland.

6. Dr J. A. Smith mentioned that, during the months of November and December, several flocks of the Mealy Redpoll, *Linota canescens*, Yar., had been observed in the neighbourhood of Edinburgh, and numbers had been taken by the bird-catchers. These birds were larger in size than the Lesser Redpoll, *Linota linaria*, Yar., none of which had been taken along with them. Specimens were exhibited, varying in brightness of colour; in some, the cheeks, breast, and the white or greyish rump, were tinged with rose-red; some had the plumage much edged with white. They had not been found in such abundance in this neighbourhood for

many years. A collector informed Dr Smith he had tried in vain to get specimens from all the bird-catchers for the last two or three years.

Dr Smith also exhibited a Crested Grebe, *Podiceps cristatus*, recently killed in the estuary of the Tay.

Richard Burdon Sanderson, Esq., Warwick House, Newcastle-upon-Tyne, was elected a non-resident member.

The office-bearers for the session were unanimously elected as follows :—

Presidents.—Robert Chambers, Esq.; William H. Lowe, M.D.; J. H. Balfour, M.D., Professor of Botany, University of Edinburgh.

Council.—Patrick Dalmahoy, Esq., W.S.; Hugh Miller, LL.D.; Robert K. Greville, LL.D.; Rev. John Fleming, D.D., Professor of Natural Science, New College, Edinburgh; William Rhind, Esq.; M. Forster Heddle, M.D.

Secretary.—John Alexander Smith, M.D.

Assistant Secretary.—George Lawson, Esq.

Treasurer.—William Oliphant, Esq.

Honorary Librarian.—Robert F. Logan, Esq.

Library Committee.—John L. Stewart, Esq.; Alexander Bryson, Esq.; Andrew Murray, Esq.

Wednesday, January 23. WILLIAM H. LOWE, M.D., President, in the Chair.

The following Donations to the Library were presented, and thanks voted to the donors :—1. Proceedings of the Liverpool Literary and Philosophical Society, No. IX., 1854-55; from the Society. 2. Essay on Meteorites, by R. P. Greg, Esq.; from Dr M. F. Heddle.

1. *Note on the Late Stay of Swallows in 1855.* By ROBERT F. LOGAN, Esq.

The late stay of the swallow tribe in this country during the past autumn had, Mr Logan stated, considering the earliness and severity of the winter, been somewhat remarkable. It was well known that the ordinary period of the departure of the red-fronted or chimney swallow (*Hirundo rustica*) was the end of September or beginning of October, and that of the house martin (*Hirundo urbica*) about the same time, or a few days later; but last autumn numbers remained during October, and towards the end of the month a small flock of martins were to be seen every morning, briskly hawking for insects, over the village of Duddingston. He saw some of them so late as the 10th of November, flying high in the air, and circling about with as much apparent ease as in the middle of summer. In the south of England, as might be expected, they remained much latter. A correspondent of the "Zoologist," writing from Hast-

ings, remarks,—“ Yesterday (Dec. 6) there were several chimney swallows flying about my house ; the previous night there had been a sprinkling of snow in the adjoining country. On the 23d of November, I left the neighbourhood of Uckfield, in Sussex, and at that time there were several house martins skimming about in front of the house though the weather was anything but warm.” Another ornithologist writes from Penzance on the 1st of December,—“ I observed up to Wednesday last, in this district, extending as far as Helston, flocks of house martins flying about, and hawking vigorously for insects.” In previous years, both species have occurred in England quite as late, and in some instances later, than the cases I have now cited ; but it is rarely they are seen so late in Scotland. In 1842, on the 9th December, one martin was seen in Devonshire. In 1843, so late as the 10th of the same month, a swallow (*H. rustica*) was shot in the West Riding of Yorkshire. This was an adult bird, in full plumage, and in good condition, which rather militates against the opinion that they are always young birds, or weakly individuals, that remain behind. In 1846, on the 18th of November, from fifteen to twenty martins were seen in Warwickshire. In 1848, one martin was shot on the coast of Suffolk. This was apparently a young bird ; and on the 8th of the same month three others were observed at Deal, hawking under the cliff. Perhaps the most singular record of all, however, is that of the occurrence, on the afternoon of January 18, 1837, on New Miller Dam, near Wakefield, of three swallows, hawking and dipping as in the midst of summer. The day is stated to have been “ very mild and still.” To complete the list, the Revs. Andrew and Henry Matthews, in their account of the birds of Oxfordshire, record the appearance of one swallow on the 28th of February 1846, and of three more on the following day. We have thus the recorded occurrence of swallows during the whole of the winter months ; and it becomes a curious and difficult question to decide whether or not any of these may have been instances of re-animated hibernation. At all events, the facts went very far to prove that swallows could occasionally remain in this country through the winter.

2. *Notice of the Arctic Skua* (*Lestris Parasitica*, Tem.), *shot in Skye in the Summer of 1855.* By PETER A. DASSAUVILLE, Esq.

The specimen on the table was procured in Skye by John Richardson, Esq., Pencaitland. It appeared to be in the adult summer plumage. The two centre tail feathers gradually tapered to a point, and exceeded the others by eight inches. The season at which this specimen was taken was not a little remarkable, as it was not known to breed even on our most northern stations, and in the sparing notices of its occurrence it had appeared in the autumn or winter.

3. *On Mesolite; Faröelite (Mesole); and Antrimolite.* By
M. FORSTER HEDDLE, M.D.

By a series of analyses of these minerals, Dr Heddle showed that *Mesolite* and *Mesole* were not only distinct from *Scolezite* and *Natrolite*, but also from each other; the *Antrimolite* of Thomson he referred to *Mesolite*, under which mineral also he considered that the *Harringtonite* of Thomson would fall.

The nomenclature of these zeolites seemed to be in a sad state of confusion. We had *Mesotype*, *Mesolite*, *Mesole*. Dr Heddle proposed that the unmeaning *Mesotype* be dropped for the expressive *Natrolite*; that *Mesolite*, as being in reality the intermediate mineral, be retained, and that *Mesole* give place to *Faröelite*, from the locality whence we obtained the choicest specimens of this substance.

From their composition, these minerals rank as follows:—

Natrolite, $\text{Na O, Si O}_3 + \text{Al}_2\text{O}_3, \text{Si O}_3 + 2 \text{HO}$.

Faröelite, $(\text{Na O, Ca O}^2) \text{Si O}_3^3 + 3 \text{Al}_2\text{O}_3, 2 \text{Si O}_3 + 8 \text{HO}$.

Mesolite, $(\text{Na O, Ca O}^2) \text{Si O}_3^3 + 3 (\text{Al}_2\text{O}_3, \text{Si O}_3) + 8 \text{HO}$.

Scolezite, $\text{Ca O, Si O}_3 + \text{Al}_2\text{O}_3, \text{Si O}_3 + 3 \text{HO}$.

4. *Mr David Page exhibited specimens of the Woodocrinus Macro-dactylus, a new genus of Encrinite recently figured and described by M. de Koninck.*

This rare and beautiful crinoid had as yet been found only in the upper beds of the carboniferous limestone in Yorkshire, and had been named by M. de Koninck after its discoverer, Edward Wood, Esq., Richmond, one of the most zealous and indefatigable of English collectors. The distinguishing features of the new encrinite were—its perfect symmetry of arrangements, the body and arms, when extended, presenting a remarkable resemblance to the free-floating star-fishes. Its base consisted of five pieces, which, branching into ten sub-basals, again subdivided into twenty tapering fingers elegantly fringed with minute plumules. The stem was also peculiar in its jointings, the pieces being of equal size in the young stage, alternately large and small in the growing stage, and in the mature form presenting a double alternation of larger with smaller jointings. In few genera of the family were the parts so elegantly and symmetrically disposed; and from the peculiar construction of the cap and fingers, there was little difficulty in distinguishing the Woodocrinus from other species. As yet it had been found only on the upper verge of the limestone, and immediately under the millstone-grit of Yorkshire; but he (Mr Page) had little doubt that the Scottish mountain limestone (which had yielded all the English forms) would also be found to contain the Woodocrinus. At all events, the *Petalodus*, which appeared to be a regular accompanying fossil in Yorkshire, had been found both at Carluke, at Bathgate, and in Fifeshire.

5. *Mr Page next exhibited some new Crustacean Forms from the Forfar flagstones, or base of the Old Red Sandstone in Scotland.*

The first of these forms presented a remarkable union of phyllopod and isopod characters; was a small creature found in shoals among the fragments of fucoid or aquatic plants; and, from its curious caterpillar-like aspect, he proposed to name it provisionally *Kampecaris Forfarensis*. The second was a larger and still more remarkable form, presenting phyllopod, pœciliopod, and xiphosarus characters. To the head of a eurypterus was united the body of a lobster, and to this lobster-like body was attached the sword-like tail of a king-crab. Its organs of motion were a pair, on each side, of long-jointed arms; and from fragments found on the slabs, it appeared to be furnished with minutely serrated jaw-feet, like the king-crab and fossil *Pterygotus*. This fossil appeared to be quite new to Palæontology; and Mr Page proposed to name it provisionally *Stylonarus Powriensis*, in allusion to its style-shaped tail, and after its discoverer, Mr Powrie of Reswallie. A third form which Mr Page exhibited was from the shaly mudstones of Upper Lanark, a series of strata apparently on a somewhat different horizon, but containing, like the Forfarshire beds, *pterygotus*, *eurypterus*, and other undescribed crustacea. This form Mr Page proposed to erect into a new family (*Slimonia*, after the discoverer of these Lanark crustacea); but as he intended to bring the subject before the next meeting of the Society, in conjunction with what was now being done in London by Messrs Salter and Huxley, he would not dwell longer on these new discoveries than merely remark—*first*, that they opened up altogether new views of crustacean affinities and arrangements; and, *second*, that their discovery established in Britain a great zone of crustacean life, either on the upper verge of Siluria or on the lower verge of Devonia, hitherto unknown to geology.

On the motion of the Secretary, a vote of thanks was unanimously given to Mr Page for his interesting communications and exhibition of new and curious fossils.

6. *On recent Discoveries in Helminthology.* By JAMES WARDROP, Esq.

Mr Wardrop gave a resumé of all that was known on this interesting and difficult subject.

Thursday, 28th February 1856.

ROBERT K. GREVILLE, LL.D., in the Chair.

Andrew Wilson, Esq., 18 Young Street, was balloted for and elected a Member of the Society.

Dr J. A. SMITH said the Society was most anxious that members would put on record all rarities which came in their way, he would therefore allude to two captures which had come under his notice. The first, a specimen of the SHORT SUN-FISH, *Orthagoriscus mola*, Cuv., was brought up with the lead-line of H.M.S. cutter Woodlark, at the mouth of the Firth, off the Isle of May, on the 17th of October last. The men on hauling in the line were astonished at the immense weight they felt, and found, on its approaching the surface, they were bringing up a huge fish,—the line being over one of the large fins, and the fish apparently simply resting against it. The following are its dimensions, for which he was indebted to Mr John Anderson, fishmonger, George Street:—From the snout to the middle of the tail, 5 ft. 4 in. ; across the tail, from the extremities of the elongated dorsal and anal fins, 6 ft. 4 in. ; and it was 1 ft. 6 in. in thickness. Its weight was about 500 lbs. The second, was a PORBEAGLE, *Lamna cornubica*, Flem., taken in a herring-net on the morning of the 17th of November last, near Inchkeith ; it measured 6 ft. 11 in. in length along the lateral line ; the dorsal fin being 1 foot in height.

The following Communications were read:—

I. *On Uigite, a new mineral (?)* By M. FORSTER HEDDLE, M.D.

Sixteen miles north of Portree, in Skye, lies the farm town of Uig. At about the fifteenth milestone, the road makes an abrupt turn to the east, before descending the hill ; and just at this spot a small quarry has been opened for the purpose of obtaining road-metal. In this quarry I obtained indifferent specimens of Faroelite, a single crystal of Analcime, and a few pieces of a substance which, being unknown to me, I analyzed, and which may be considered new. Should this be admitted, I would propose for it the name Uigite. It occurs in small nests in the amygdaloid, which is here very vesicular, is not distinctly crystallized, being in radiated sheafy plates, somewhat resembling the structure of a plumose mica, but in general appearance intermediate between Faroelite and gryolite ; colour white, slightly yellowish ; lustre tremulous and pearly : hardness, 5.5, brittle ; specific gravity, 2.284 ; before the blow-pipe fuses readily and quietly, with strong reaction of soda, to a white opaque enamel, which is not frothy. On ana-

lysis, it afforded 45.98 per cent. of silica, 21.93 of alumina, 16.15 of lime, 4.7 of soda, and 11.25 water. These proportions give equivalents,—silica, 7; alumina, 3; lime, 4; soda, 1; water, 9. The mineral, therefore, consists of 1 equivalent of a silicate of lime and soda (where the lime is to the soda as 4 to 1), 1 equivalent of a sesquisilicate of alumina, and 9 of water. The calculated percentage proportions of which compound are,—silica, 46.09; alumina, 21.93; lime, 15.97; soda, 4.46; water, 11.55; which agree closely with the analytical results. No mineral has the above formula, which differs, however, from that of Faroelite (Mesole), merely in the insertion of the compound $2(\text{Ca O}, \text{Si O}) + \text{H O}$. We have now to see if it be not a compound mineral, *i.e.*, a combination of two minerals (being capable of expression by a rational formula, it cannot be a mixture). For this purpose, let us look for an instant at gyrolite, the new mineral lately discovered by Dr Anderson in Skye. That chemist gives $2(\text{Ca O}, \text{Si O}_3) + 3\text{H O}$, as the formula of gyrolite, which requires 15.40 per cent. of water, but admits that the mineral readily loses water, and that none but specimens newly broken from the rock contain so large a quantity. While I myself am strongly inclined to think that even fresh specimens have an atom less of water, yet I am not at present prepared definitely to assert so, but I am prepared to assert the specimens of gyrolite ordinarily procurable, and such as are to be found in cabinets, have more probably the formula $2(\text{Ca O}, \text{Si O}_3) + \text{H O}$ —as I have obtained many such percentage proportions of water as the following:—6.417, 5.98, 6.83, &c., the last given formula requiring 5.72. Gyrolite would thus seem to be a mineral which, like lomontite, loses a certain quantity of water at once on the very exposure to the air, and, like lomontite, this loss is accompanied with other changes, as of form, colour, lustre, &c.; for, when fresh, gyrolite is colourless, transparent, of a vitreous lustre, and tough; after a short exposure it becomes white, opaque, of a pearly lustre, and crumbles readily. Now, this latter formula of gyrolite is the very compound which we have to add to the formula of Faroelite, to convert it into the form of Uigite, as before shown. Three equivalents of Faroelite, united with one of gyrolite, will give a compound having the following percentage proportions:—Silica, 46.51; alumina, 21.20; lime, 16.62; soda, 4.31; water, 11.36; agreeing closely with the analysis of Uigite, and giving the same formula. I have already noticed that in appearance Uigite stands intermediate between the above minerals. Under this consideration of the subject, therefore, Uigite is made up of three equivalents of Faroelite, and one of gyrolite; if we are not allowed to consider gyrolite as having ordinarily the above formula, then Uigite must stand as a simple and not a compound mineral. Mineralogy is in that stage when the men of the present age have to draw the sponge through many of the works of those who have gone before them, to have their own in turn expunged by those who follow after. Fearing that this

might be the fate of Uigite, I do not dogmatically thrust it into the world as a new mineral, but waiting for more information, would merely make a note that such a compound as I have described is to be found at Uig, in Skye.

II. *Remarks on the Scientific bearings of recent discoveries in Helminthology.* By JAMES WARDROP, Esq.

III. *Notice of a curious Metamorphosis in a Zoophyte-like Animal.* By CHARLES W. PEACH, Esq., Wick.

In March last year, I obtained from a fisherman's line an old and much corroded valve of *Psammobia ferroensis*, which had been hooked up from deep water; on it I noticed jelly-like spots, and placed it in a shallow glass of sea water; the next day I fancied that I could make out, with my pocket lens, zoophyte-like animals. At once I transferred the shell in a watch glass, filled with sea water, to my microscope, and was delighted to find my suspicion correct, for after a little management, so as to catch the light, I could see the forms as figured (Fig. 1) attached to the shell by a short

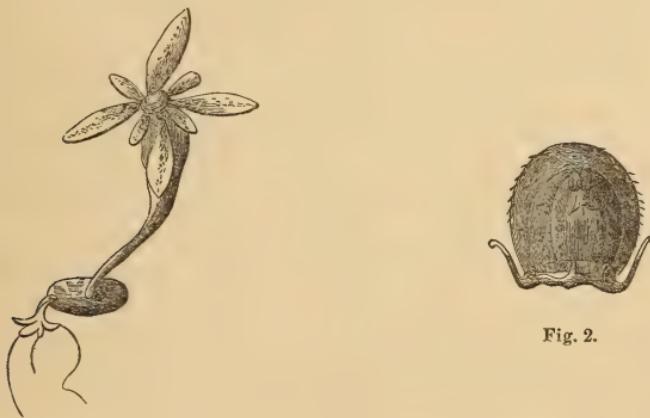


Fig. 1.

Fig. 2.

foot-stalk, a little inflated near the upper part, tipped with a slightly raised and rounded centre, from which extended four long and four short leaf-like arms, each granulated down the centre; one or two had, in addition, springing from these, delicate tentacle-like arms, probably in a farther stage of development. They were easily disturbed, but soon again displayed themselves; their transparency, added to this shyness, rendered it difficult to catch their forms. At first I thought they were the early stage of a *Hydractina*, and probably, *H. brevicornis* of Müller, mentioned in Johnston's second edition of "The British Zoophytes," page 35.

My next examination was on the 2d of April. After giving them a supply of sea water, they were still fixed; I could, however, perceive a difference, the centre of the head more raised and cone-shaped, and the arms shorter. I continued my examinations daily; and on the 6th, instead of moored creatures, I had a fleet of probably one hundred minute, free, naked-eyed, medusoid-like beauties (Fig. 2), jerking about in all directions, with the exception of size all alike, perfectly transparent; the umbrella well rounded and pilose; the sub-umbrella large; each had four large ocelli-like bulbs on the edge of the mantle, furnished with a stiffly turned-up tentacle, tipped with a disk having a dark centre; this surrounded by a light ring, and outside a darker edge, dark but short bars arranged in a quincunx manner on these tentacula. The ocelli were composed of minute, dark granules. As well as these long tentacula, there were four smaller and shorter ones, also turned up, but no ocelli where the edge of the mantle is shown. On the lower part of the mantle runs a canal communicating with the bulbs of the large tentacula; in the canal I observed a granular circulation passing along, and, as if revolving in the bulbs and a short way down each large tentacle; into these bulbs smaller granules descended from the sub-umbrella, by the gastro-vascular canals; these canals extended to the upper part of the stomach, the stomach being attached to them, and is rounded on the upper part, and divided into four lobes; it then narrows and runs out bell-shaped to the quadrate mouth, which has four long lips fimbriated at the tips. They were very active up to the 10th, when some little change took place. I supplied small quantities of water, and used every precaution, from being anxious to see all I could of them. On the 11th they became sickly, and the upper part of the umbrella in eight festoons, the tentacula slightly drooping. On the 13th, nearly inactive, hyaline, and *turned inside out*. I began to hope that, as the mouth *had become elongated* into a peduncle-like form, they were about to become fixed again; they, however, dwindled away, and although I kept the water for months, I could trace nothing more. I have not yet seen Steenstrup's work on "The Alternation of Genera," therefore am unable to say whether it may be one of the interesting facts noticed by him. They differed in the *fixed state* from any of the zoophytes figured and described by Johnston; and when *free* from all the naked-eye medusæ figured in the monograph of Forbes, it may be one of the latter in its earlier stages, and probably is, *from being pilose*, this being the case with many of the young of the medusoid tribe which have fallen under my notice, and I have seen many. This is the most interesting of all. The most like the free state, is *Lizzia octopunctata* of Forbes, Pl. xii., fig. 3; it agrees thus far in the form of the umbrella, in having 8 tentacular bulbs, 4 gastro-vascular canals, the shape of the stomach, quadrate mouth, and long fimbriate-tipped lips. It differs in being pilose, and having only 8 tentacula, instead of 20, viz., 3 at each large

ocelli bulb, and 2 at each of the smaller ones ; even this difference in the number of tentacula, &c., ought not to put it out of court, for I have seen, and have a long list of notes and numerous drawings of the strange changes from the young to the adult state of these lovely gems. At present I cannot spare the time to make the drawings and extend the notes. I present this fact, so that others may be aware that such transformations are to be met with on our own coasts, and that by watching for shells from deep water thus begemmed, a series of observations may be made, and more facts collected, so that the true nature and phases of these Proteus-like objects may be made out.

IV. *A Letter was read from the Rev. H. M. WADDELL, Old Calabar, to ANDREW MURRAY, Esq., containing additional information regarding the new Electric Fish (Malapterurus Beninensis, Mur.)*

Mr WADDELL writes as follows :—“ As you attach some importance to an observation I had formerly made concerning the power of the small electric fish of this river to benumb other fish with which they come into contact, I should have verified my observation by renewed experiments. An opportunity soon offered of accomplishing this object, and I now communicate the result, which you will probably deem to be of a very satisfactory description. I have four electric fish in a large basin, the largest about six inches long, and as thick as the neck of a quart bottle ; the smallest about three inches long, and the thickness of your finger. They have been there in a healthy state for some months. I procured eight small fishes, varying from two to three and a half inches in length, which I put in with the others. The electric fish continued, as usual, side by side, quiescent at the bottom, while their visitors swam and darted about in a lively manner, and even ventured down among their dangerous neighbours, rousing them to activity, passing through their ranks, and disturbing them not a little, without seeming to be either afraid of them or molested by them. They frequently rubbed sides without any effect similar to what I had before observed being produced, and I began to fear that my former observation would not be confirmed. Having watched their movements in vain, I retired for a while, but returned in half an hour to see how they were getting on. I then found the new-comers, all but one, the largest of them, lying at the bottom among the electric fish. Having taken out the seven which were evidently struck, I found four of the smallest quite dead and stiff, their backs twisted or curved, and their mouths gaping open. Three of them, though much benumbed, revived when transferred to another basin of water, and, after an hour or two, recovered perfectly, and were as lively as before. The one which escaped at first was left with his dangerous companions, but was not so lively as at the first. It would swim about a little, then sink, again rise and make

a few darts, and then sink again. Tired of watching him, I went on with my book, but after a little returned, and found him quite dead, his back curved downwards very considerably, and his mouth gaping half an inch open. Taking him by the tail, I lifted him out as stiff as if frozen, and further, observed his colour quite gone ; a very dark brown before, he was now as pale as ashes. I had noticed something of this change of colour in the first four affected, but not of so marked a kind as in this last one. The three which recovered from the first attack remained to be tried again, and were put in with the electric fish a second time, when quite strong and lively. They swam and frisked about as playfully and safely as on the first occasion, and I watched them intently, and for a longer time than before, but observed no movement on the part of the electric fish, though the others sometimes darted down among them. They seemed to be more intent on eyeing me than minding their little visitors, one of which was nearly three inches long, the others about two each. Tired of looking and seeing nothing, I left them as before, and after a little returned, when all three were lying benumbed at the bottom. Being removed to another basin, one of them revived, the others were dead. The dead ones were not, however, so powerfully affected as their companions in misfortune ; they were not rigid, nor contorted, nor pallid, nor gaping. Obviously they were not so severely struck as the others had been, the powers of the electric fish being probably by this time somewhat weakened. The one that still survived recovered completely to admit of a new experiment. I confess to some misgivings of feelings on subjecting it to a third and final trial ; but a remark in your note, if the electric fish eat those they stunned, was yet unanswered. Therefore, in retiring for the night, I gave it to them for their supper, if they should have any fancy to make that use of their victim. But in the morning I found him, though dead, yet otherwise uninjured. If you ask me what do they live on ? I cannot answer. Those with me eat nothing. They are on my study table, and I see them daily, but give them nothing. Even their water is seldom changed, yet are they strong and lively. As I am told that they lie much in the ooze at the bottom of the river, I have given them sand to lie on, which they sometimes stir up with their tails. A few times daily, but chiefly in the evening and early night, they plunge about and make the water muddy. I cannot learn that they have been ever found larger than a herring."

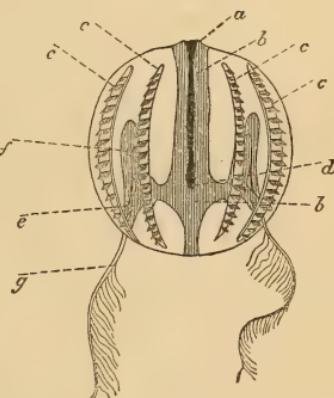
Specimens of the *Malapterurus*, recently received from Calabar, were again exhibited to the Society by Mr WILLIAM OLIPHANT, and were by him presented to Members, for further examination into their electric organization.

V. *On the Reproduction of Cydippe pomiformis.* By T. STRETHILL WRIGHT, M.D., Fellow of the Royal College of Physicians, Edinburgh.

Accounts of *Cydippe* may be found in every manual of Natural History and Comparative Anatomy. Those written by British authors are generally distinguished by a singular variety in error both of description and illustration. I have, therefore, thought it necessary to give to the Society a sketch of its anatomical structure, as maintained chiefly by Agassiz in his admirable work on the Acalephæ of North America, and which my own observations assure me is correct.

Cydippe (see fig. 1) may be briefly described as a transparent ovoid body of gelatinous consistence, having its surface longitudinally sulcated (like that of a melon) by eight furrows, in each of which lies a band of muscular tissue. These muscular bands serve as a basis of attachment to numerous flat paddles or comb-shaped fringes of cilia, which are ranged at nearly equal distances along the whole length of the bands, and form a locomotive apparatus by which the animal rows itself through the water with admirable swiftness and grace. In the allied acalephs, *Beroe*, *Alcinoe*, and *Bolina*, each of these paddles is a transparent plate, more or less divided or fringed only at its extremity, while in *Cydippe* the plate is entirely divided to its attachment into a fringe of separate cilia. Agassiz considers that the cilia are composed of a peculiar substance, but I find that their action on polarized light is proportionate to that exerted by a plate of horn of equal thickness. The cilia are, therefore, in all probability, setæ and their embryonic development, hereafter described, indicates that they are analogous to the locomotive setæ of the

Fig. 1.



a. Mouth opening into stomach, which communicates at d with b b large central canal of water-vascular system. c c c c Longitudinal muscular bands carrying ciliary paddles, and covering the lateral water-vascular canals. e e Transverse water-vascular canals. f Receptacle of the tentacles g.

Annelides. Immediately beneath, or internal to the muscular bands, and corresponding with them in length and breadth, are eight canals excavated in the gelatinous tissue of the animal, and connected by a system of transverse branches with a much larger cavity, which occupies the axis of the body along its whole length, and admits the sea-water by two orifices situated at its inferior extremity, capable of being opened or closed at the will of the animal. The whole of these canals form a water-vascular system, through which a constant circulation of fluid takes place, urged by the fine cilia with which the cavities are lined.

The digestive system consists of a flattened sac, about two-thirds the length of the animal, suspended within the large central canal of the water-vascular system. The upper extremity of this sac terminates in a linear mouth situated on the upper surface of the body, while its lower extremity opens into the large canal in which it is inclosed, so that the products of digestion are (as in *Actinia*) at once admitted into the main cavities of the body, in which the functions of nutrition and respiration are carried on together. There also exist two other large cavities in the body connected with the water-vascular canals, which serve as receptacles for the tentacular apparatus, the use of which has caused much difference of opinion amongst writers on this branch of Natural History.

As far as I have been able to ascertain, nothing is certainly known as to the reproduction of *Cydippe*. Siebold (in his work on Comparative Anatomy) has stated that Mertens has observed detached corpuscles from the body of *Cestum* and *Cydippe* swimming freely about and rapidly enlarging, but that his observations were there limited. Professor Grant has imagined that he has detected ovaries, consisting of two lengthened clusters of small spherical gemmules, of a lively crimson colour, extending along the sides of the stomach; but his description of the anatomy of *Cydippe* is so inaccurate, that his remarks on its ovarian system are not to be relied on. Mr Robert Paterson of Belfast (who has written an excellent monograph on this *Aculeph*) has not been able to verify Dr Grant's observation, although he has examined several hundred speci-

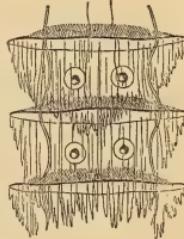
mens; but he has seen numerous transparent gemmules in the water in which Cydippes were kept. Agassiz states, that although he had kept Cydippe alive for months during the spring, he had never seen in any of them anything like ovaries or spermares. He also writes that although he has watched Bolina through six successive months, from December to June, he had never succeeded in discovering the sexual system even in its most rudimentary state, and that of their embryonic development nothing is known; and yet these Acalephs frequently swarm in the seas both of Europe and America. The reproductive processes in several species of the pulmograde Acalephæ have been investigated with great success by Sars, Dalyell, John Reid, Steenstrup, and others. The Steganopthalmata (of which *Aurelia aurita*, the common "jelly-fish" of the Firth of Forth, is an example) at certain seasons of the year pour forth from their ovaries multitudes of germs, which affix themselves to shells and other bodies, and become many-tentacled hydraform polypes. These polypes, after multiplying by gemmation for many months, perhaps years, begin to resolve themselves by transverse fissure into minute medusæ, which undergo many changes before they arrive at their adult form and size. The Gymnophthalmata (those tiny naked-eyed medusæ which, visible to the naturalist alone, swarm in immense multitudes around our coasts) emit ova which are developed into polypes of various form, either single, as *Corymorpha*, or united together by creeping fibres or stems, in colonies of plant-like form, as *Clava*, *Coryne*, *Tubularia*, *Campanularia*. In spring, these zoophytes put forth buds, either from their polyparies or from the polypes themselves. The buds rapidly enlarge, and are developed into bell-shaped medusæ, which, after remaining attached for a short time to the parent stem, become detached, and flap themselves away in the surrounding water. The reproduction of these plant-like animals bears, indeed, a remarkable resemblance to that of the true plant. The flower of the plant produces a seed, the medusa of the zoophyte an ovum; the seed grows into a stem and leaves, the ovum into a stem-like polypary and polypes; the plant multiplies itself by suckers and bulbils, the polypary by

stolons and gemmæ; the plant puts forth flowers, the polypary medusæ, which alone have true reproductive organs.*

* *Note on diœcious reproduction in Zoophytes.*—I have stated the development of medusæ from polypes, in accordance with the elegant expression of the fact first given by Dr Carpenter, but there is still some obscurity with regard to this subject. It is not correct to state generally, that *Campanularia*, *Tubularia*, *Coryne*, and *Clava* produce medusa-buds, although some varieties of all these species do so. Schultze has observed in *Campanularia geniculata*, in place of medusa-buds, the production of capsules filled with spermatozoa. The production of ova, and their direct development into young polypes, has been noticed in the ovarian capsules of *Tubularia indivisa* by Mummery. I have repeatedly seen large polyparies of *Coryne glandulosa*, all the polypes of which bore buds containing spermatozoa, developed from a stalk traversing the axis of the bud, the whole polypary being, in each case, unisexual and male. While in other polyparies of the same zoophyte, the reproductive buds were filled with ova also developed from the exterior of a hollow central stalk, a diverticulum of the alimentary canal; the entire polypary in these cases being female. In some species of *Clava*, the polypes (which are not separate as hitherto described, but attached together by a fleshy basis, investing a horny polypidium somewhat similar to that of *Hydractinia*, or by a slender creeping thread inclosed in a membranous sheath) bear reproductive capsules, some of which contain spermatozoa and others ova; but the polypes bearing male capsules are never found grouped on the same polypary with those carrying female capsules. I may state that many, if not all, the composite hydroid zoophytes are not only unisexual with regard to their individual polypes, but also diœcious, the male and female reproductive organs being always situated on different polyparies. I have already observed diœcious reproduction in *Coryne glandulosa* (Dalyell), *Clava*, two species, *Hydractinia echinata*, *Sertularia cupressina*, *Plumularia falcata*, *Campanularia lacerata*, *Sertularia rosacea*, and several others. I hesitated for some time to agree with Drs Allman and Carpenter in considering the marcescent reproductive capsules, which in some of these zoophytes appear at first sight to be mere sacs, filled with spermatozoa or ova, as homologous with the budding medusæ, in which the organs of sensation, locomotion, nutrition, and even of reproduction, are highly developed and distinctly differentiated, which maintain an independent life long after the decay of the polype from which they have budded, and some of which multiply themselves indefinitely by gemmation before their true sexual organs appear; but I am convinced, after careful examination of many genera, that this is nearly a correct view of the case. The peduncle of the medusa-bud appears to me to be homologous with the entire reproductive capsule (of *Coryne glandulosa*, &c.), and the umbrella to be a superadded organ, having the nature of a polypary or cœnosarc (Allman). Very lately I have found at the Scougal Rocks, near North Berwick, a very interesting *Coryne*, in which each polype of the cluster bore a single long cylindrical medusa-bud without tentacles. The peduncle consisted of a thick white mass nearly filling the umbrella, and was found to consist of an inner and outer coat (endoderm and ectoderm) widely separated from each other

Agassiz, after careful examination of *Cydippe* and *Bolina*, and comparison of their anatomy with that of *Sarsia mirabilis*, one of the *Gymnophthalmata*, considers it highly probable that the former are, like *Sarsia*, the product by gemmation of hydroid polypes; and he particularly directs the attention of future investigators to the determination of this question. On this point it has been my good fortune to make the following observations: I found in the water of Morecambe Bay, one day in June 1853, swarms of the *Cydippe pomiformis*. Every little creek and channel in the sand-banks was full of them, where a day or two before and afterwards not one was to be seen. On examining one of these animals confined in a jar of sea-water, I observed a great number of transparent vesicles in the lateral water-vascular canals. Some of the vesicles were floating freely in the circulating fluid, but the greater number were attached in pairs to the inner surface of the muscular bands, a pair between every two of the ciliary paddles, fig. 2. The constant motion of the paddles rendered it difficult to ascertain the true nature of these vesicles; but the next day a considerable number were floating freely in the jar, and were placed under the microscope. They consisted of a transparent and highly refractive vitellus, containing a germinal vesicle and germinal spot, and surrounded at a considerable distance by a thin envelope or shell. Several of the ova were placed in a small trough of sea-water, and carefully watched for some days, but no further development occurred in them. In the meantime the water containing the parent *Cydippe* was examined every day with a single lens, and after a few days minute bodies about the size of a rape-seed were detected swimming amongst the eggs. These proved to be the hatched young of *Cydippe*. The rest of the ova were found in all stages of the advance towards full development. In illustration by a mass of well-formed spermatozoa; the two coats were united at the mouth, which was surrounded by a ring of large thread cells. The peduncle was, in fact, but little advanced from the simple sperm-sac I have described above. All the medusæ on the polypary were males. May we not infer from this the probability of the medusa-bearing zoophytes being also dioecious?

Fig. 2.



tration of which I have given the accompanying sketches. Fig. 3 shows the newly extruded ovum with yolk and shell. In fig. 4 the yolk has become irregular in shape by cleavage, granular, and opaque. In fig. 5 the embryo is elongated into an irregular cylinder, and is encircled by a wreath of long cilia, by which it is rapidly whirled round in the shell. In this stage it bears a close resemblance to the embryo of an annelid (*Phyllodoce*) when newly hatched. In fig. 6 the ciliary

Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.



wreath of fig. 5 is broken up and divided into four bundles, the upper part of the embryo has become hyaline, by the gradual absorption of the yolk, and the tentacles have appeared, as simple granular threads, and destitute of the lateral cirri which adorn those of the adult. In fig. 7 (the newly-hatched *Cydiippe*) the four bundles of cilia have extended themselves into short bands,—a still further absorption of the yolk has taken place; and the tentacles have become greatly lengthened. My observations were here arrested; all the young *Acalephs* died at this stage, which they attained in about five days. The *Cydiippe*, when newly released from ovum, is still in a low state of development. I have not been able to detect in it either mouth or water-vascular canals; the ciliary bands are only four in number, instead of eight, as in the adult; the tentacles are not yet fringed; a considerable part of the yolk still remains to be absorbed, and is amassed at the lower extremity of the animal and about the ciliary bands, where the lateral tubes of the water-vascular system may be looked for. In this respect it bears a remarkable resemblance to the medusæ of some of the coryne-form polypes, in several species of which I have noticed that the walls of the radiating tubes,

Fig. 7.



and those of the circular tubes round the mouth of the umbrella, are for some time after detachment, rendered opaque by a layer of red granular matter, which is completely absorbed as the animal advances towards maturity. It is probable that the young Cydippe undergoes several changes before it arrives at maturity, but I was never able to find it again in its first or more advanced stages in the waters of Morecambe Bay. I had looked in vain for spermares in several specimens of the adult in which there were no ova. It can, indeed, be scarcely said to possess even ovaries, as the eggs are not amassed together in groups, but are developed separately from the wall of the lateral tubes of the water-vascular system.*

This notice on the reproduction of Cydippe is, therefore, incomplete; but I have thought it advisable to bring it before the Society, as I may not have an opportunity of pursuing the inquiry farther, and it possesses some importance, in so far as it proves that the generative process in this class of acalaphs is very different from that which obtains in the stegano-ophthalmatous and gymnotophthalmatous medusæ.

On the function of the tentacles.—The function of the tentacles in Cydippe has always been a *quæstio vexata* amongst naturalists. These magnificent appendages are generally found closely packed in two large canals communicating with the water-vascular system, and opening by wide apertures in the lower hemisphere of the body. When the Acaleph is floating at rest near the surface of the water, the tentacles are expanded, and depend from beneath, like long white curling plumes, to a distance of twenty times the length of the animal. Each of these organs consists of a single tubular thread, fringed on one side by numerous closely-set cirri, which are ranged parallel to each other like the teeth of a comb or the barbs of a feather. Their surfaces are crowded with minute thread cells, or stinging organs, and the whole apparatus is capable of being instantly

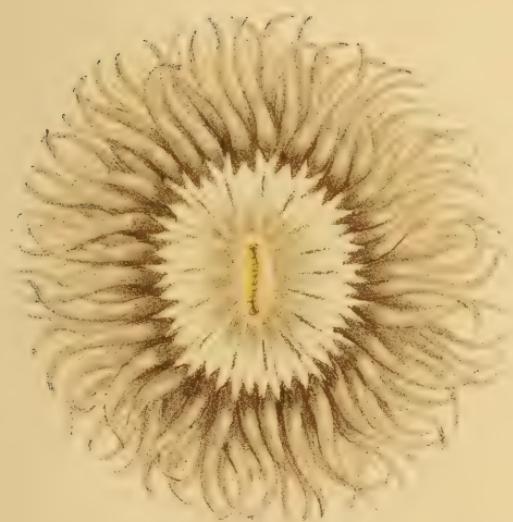
* Since the above was read to the Society, I have, through the kindness of Mr Goodsir, received the *Horæ Tergestinæ* of Will, who, in his account of the reproductive system of *Eucharis multicornis*, an acalaph allied to Cydippe, describes the ovaries and spermares as attached to opposite sides of the lateral water-vascular canals. He therefore makes these animals hermaphrodite, a fact which is open to doubt.

retracted within its cell at the approach of danger. Blainville regarded the tentacles as instruments for the capture of prey. Patterson has contested this opinion, and believes that they cannot be made to approach the mouth, as they are situated at the opposite extremity of the body. Dr Carpenter regards them as locomotive organs; but it is difficult to imagine how they can be used for that purpose. I had frequent opportunities of seeing these animals taking their prey at Morecambe Bay by the aid of their tentacles, and was delighted with the address they displayed in using these seemingly unmanageable appendages. The food of Cydippe was easily ascertained, as the stomachs of many of the specimens taken were packed with minute crustacea. To ascertain how the latter were captured, I threw one of them into a jar in which was a Cydippe which had evidently not dined that day. It was instantly caught by one of the tentacles. The Acaleph at once became very animated, and performed a series of somersaults until it had succeeded in hitching the tentacle which held its prey across the widely-gaping mouth as over a pulley. The tentacle was then contracted by successive jerks, until the morsel was hauled up to and dropped into the stomach. This experiment was frequently repeated, with precisely the same results, by myself and friends, with the same and other species of Cydippe.

VI. *On Two new Actinias from Arran.* By T. STRETHILL WRIGHT, M.D., Fellow of the Royal College of Physicians, Edinburgh. (Plate VI.)

(1.) *ACTINIA ORNATA.*—*Body cylindrical, smooth, orange-brown, spotted with white; tentacles quinqueserial, four inner rows grayish-white banded with purple-brown, outer row half the length of inner rows, orange tipped with gray.*

I found this very showy Actinia in September last on the shore below South Corrigills, Isle of Arran. It inhabited small deep basins in the rock, situated nearly at high-water mark, and densely filled with a variety of algæ. When the algæ



ACTINIA ORNATA.

were pushed aside the brilliant colours of the Actinias rendered them very conspicuous, and at once assured me that I had discovered a new species. The largest specimens, when fully extended, measure about $2\frac{1}{2}$ inches in length by $1\frac{1}{2}$ inch in diameter. The body is a rich orange brown marked with white spots. These spots, which are very small at the foot of the animal, increase in size as they approach the disk. They are arranged along faint yellowish lines which run parallel to each other from the base to the disk. The ground colour of the disk is generally a uniform deep purple-brown, which passes between the tentacles and marks their base with irregular lines and reticulations, but in some specimens the uniformity of colour is broken by irregular cloudy patches of transparent pearly white. The labial lobes of the mouth are orange, and are placed in the centre of a star of sixty fulvous rays, thirty longer and thirty shorter placed alternately; the long rays are slightly forked at their extremities, like the scales of a moth's wing; the short ones terminate in a rectangular point. The tentacles, about two hundred in number, are arranged in five rows; the four inner rows are grayish-white, encircled by broad bands of pale purple-brown. The outer row consists of about one hundred closely-set tentacles, half the length of the inner rows; their colour is gray, but about three-fourths of their upper surface is coloured from the base towards the tip by a broad patch of orange-red (red-lead). *Actinia ornata*, when irritated, ejects fulvous threads in great profusion from the mouth and the pores in its body into which they are again withdrawn. These threads are covered with the usual urticating cells, and writhe about as they depend from the animal. They are moved partly by the contractility of their walls, which throws them into spiral coils, and partly by the cilia with which their surfaces are covered. They attach themselves with considerable tenacity to any animal substances with which they come in contact, and no doubt constitute a formidable apparatus for defence.

Four young ones, produced by as many specimens of *Actinia ornata* in the last six months, were born with a double row of tentacles, the inner long, the outer short and tinged with orange-red as in the adult. The figures in Plate VI., en-

graved from a beautiful drawing by Mr Weisse, artist, Queen Street, show the animal in different stages of expansion and contraction. The lithographer has given too purple a tinge to the tentacles, otherwise the plate is very characteristic.

(2.) *ACTINIA BELLIS* var. *fusca*.—*Disk and tentacles of a uniform brown.*

Actinia bellis, which is not described by Johnson as a native of Scotland, was found in great numbers in the rock-pools below South Corrigills. The common variety, with a variegated disk, described by Gaertner, Hassall, and Couch, was the more abundant; but a very beautiful one also occurred, the disk and tentacles of which were a pure unmixed brown of various shades. The body was white, pure pink, or pink marked with spots or crossing lines of white. This variety was very constant, and showed no disposition to diverge into the common one. In some of the pools these Actinias were assembled in large masses, and so closely packed together that their disks only were visible, and they were at first mistaken for a thick growth of algæ. They were never found intermingled with the other variety. In captivity both varieties proved very prolific; the young of the brown Actinia could be readily distinguished from the others by their dark disks, and by the brown lines with which their bodies were striated. These lines correspond to the internal longitudinal septa, and disappear with the increasing age of the animal.

Wednesday, 26th March. WILLIAM H. LOWE, M.D., President,
in the Chair.

The Rev. Zerub. Baillie, of the United Presbyterian Calabar Mission, was duly elected a Member of the Society.

The following Communications were read :—

I. *On Zoological Classification.* By Professor MACDONALD,
St Andrews.

Professor MACDONALD submitted to the consideration of the Society the system of classification he had for some time prepared, which, he considered, possessed advantages over any of those now in use.

II. *Monograph of the Genus Catops.* By ANDREW MURRAY, Edinburgh.

Notwithstanding Mr. Spence's able Monograph of the British species of this genus, and the excellent works of Erichson, Sturm, Redtenbacher, Kraatz and others, its study is still attended with so much difficulty, that I imagine the following attempt to clear up the synonymy, and to make the species more easily recognizable, will be welcome, particularly to British entomologists.

When I commenced my examination of the genus, with a view to publishing the results, I applied to my entomological friends for their assistance both in the way of information and communication of specimens, an application which was cordially responded to. I have thus had the advantage of carefully examining Mr. Waterhouse's collection, which I believe to be the best representative of the Spencian species extant;—the determination having been submitted to and approved by Mr. Spence himself, with this qualification, that he (Mr. Spence) had described some of his species from specimens belonging to others, to whom they had been returned, so that the type specimens were scattered, and the certainty of accuracy derivable from the actual comparison of specimens with the types was in these instances no longer attainable. It is on the faith of Mr. Waterhouse's collection therefore that I principally depend for the identity of the names with the species described by Spence, where the descriptions themselves have failed me.

From Mr. Stephens's collection now in the British Museum I have in like manner endeavoured to identify the species described by him, and as his specimens of Spence's species in a majority of instances correspond with Mr. Waterhouse's, they so far confirm the authority of that gentleman. I have further had the advantage of examining the species in the *Jardin des Plantes*;—those of M. Lucas and of M. Chevrolat (who left the whole of his large collection of *Catops* for months in my hands), and those of M. Fairmaire, M. Javet, and other French entomologists. To M. Kraatz of Berlin, whose elaborate and admirable revision of the European species of the genus shows the attention he has bestowed upon the subject, I owe especial thanks. Besides favouring me with his opinion upon my ideas, he has furnished me with a nearly complete series of his species, and entrusted those he could not spare to me for examination, so that I have in general the advantage, when speaking of any view entertained by him, of knowing with certainty the identity of the species under discussion. In relation to the North American species I beg particularly to record my obligations to

Dr. Leconte of Philadelphia, Dr. Asa Fitch of Salem, and Mr. Calverly of New York. To our British entomologists, Dr. Power, Mr. J. T. Syme, Mr. Hislop, Rev. W. Little, Rev. Hamlet Clark, Mr. Guyon, Mr. Bates, Dr. Lowe and others, I also owe many thanks. They have entrusted to me the whole of their species for as long a period as I chose to retain them, and the whole of the gentlemen I have named have liberally placed their duplicates at my disposal. I take this opportunity to tender to each of them individually my best thanks for their kindness.

With this acknowledgement of my obligations and explanation of the sources of my information, I shall now in the first place cast a rapid glance at what has been done by previous authors, first in the European species and afterwards in the exotic; I shall then give detailed descriptions of all the different species which have been described or have come under my notice (among which will be found one or two new species), and lastly conclude by giving a short dichotomous table of the characters of the European species of the genus.

The species which compose this genus were scattered by ancient authors among several other genera. DeGeer placed one species under *Dermestes*, and Geoffroy another under *Silpha*. Fourcroy placed the only one he knew under *Peltis*, Panzer under *Helops*, Fröhlich under *Luperus*, Fabricius under *Cistela* and *Hydrophilus*, Marsham under *Mordella*, and Linnæus (possibly) under *Chrysomela*. Latreille was the first who, in his 'Précis des Caractères Génériques des Insectes,' established the genus under the name of *Choleva*. This was in 1802, and about two years after it was also recognized first by Paykull, and afterwards by Knoch, who each gave it another name—Knoch that of *Ptomaphagus* which was adopted by Illiger, and Paykull that of *Catops* which was adopted by Fabricius, and has been retained by most subsequent authors. By the rule of priority therefore the name should be *Choleva*, but I am glad that I have a sufficient apology for not disturbing the almost universally adopted name of *Catops*. Latreille himself appears at first only to have applied his name to one section of the genus. This appears from his 'Histoire Naturelle des Crustacés et des Insectes,' where in speaking of his constituting the genus, he says, "Its appearance, says Geoffroy, resembles that of the *Mordellæ*, that is to say, it has long legs with which it walks as if it limped. It is from that character that I have taken my generic denomination: *Choleva* in Greek means 'lame.'" The long legs here referred to apply to the first section of the genus, which was subsequently erected into a separate genus by Stephens, and may, I think, be properly maintained as a subgenus, to which Latreille's name may be restricted.

The number of species at first described was small. Latreille in his 'Hist. Nat.' only describes three, and in his 'Genera Crustaceorum et Insectorum,' published in 1807, he describes five. He there breaks the genus into two groups, one corresponding to the subgenus *Choleva*, of which he describes the species *agilis* and *angustatus*, auct., and the other including the rest of the genus.

Gyllenhal in 1808 published six species in the first volume of his 'Insecta Suecica.'

It is unnecessary to enter into any examination of the synonymy of the species described by these authors. Their descriptions are for the most part too vague and applicable to too many species subsequently described to allow us to rely greatly upon them. Gyllenhal in his 4th volume, which was not published till 1827, acknowledges that in his 1st volume he had included five different species under one name.

Mr. Spence was the first author who brought the genus into something like order.

In his Monograph (published in the Linnæan Society's Transactions in 1815) he divided the genus into three main sections, dependent upon the antennæ being filiform or clavate, the posterior angles of the thorax obtuse or acute, and the elytra striate or not striate; the dilatation or non-dilatation of the first article of the middle tarsi in the males was also made a subordinate character. Of these, the first and last are the only ones which have been adopted as sectional characters by subsequent authors; but the form of the hinder angles of the thorax, although not a good sectional character by itself, will, I think, if taken in conjunction with the base of the elytra, be found to furnish good characters for natural subdivision. Mr. Spence groups his species under the above sectional characters (to each of which I shall attach the synonym now most in use) as follows, viz. :—

* *Antennæ subfiliform; posterior angles of thorax obtuse* (= Subgen. *Choleva*, Steph.).

C. oblonga = *angustata*, Fab., Erich.

C. agilis = *agilis*, Ill., Erich.

** *Antennæ clavate; posterior angles of thorax acute; elytra for the most part striated* (= Subgen. *Catops*, Steph.).

(*Anterior thighs for the most part thickened at the apex in the males, and first article of middle tarsi dilated.*)

a. *Basal margin of thorax excised near the angles.*

C. nigricans = *nigricans*, Erich.

C. sericea=*fuscus*, Panz., Erich.*

C. tristis†=—?

C. festinans‡=—? (possibly *grandicollis*, Erich.).

b. Thorax with the basal margin straight near the angles.

C. chrysomeloides=*chrysomeloides*, Panz., Lat., Sturm.

C. Leachii§=*tristis*, Erich.

C. Kirbii||=*rotundicollis*, Kellner.

C. Marshami¶=—? (either *morio*, Erich. or *nigrita*, Erich.)

*C. dissimulator***=—? (probably *morio*, Erich.)

* Erichson, and after him Kraatz, give *C. picipes*, Fab., as the synonym of Spence's *sericea*, but I think this is a mistake. The description better accords with *fuscus*, and I believe that *picipes* has not yet been found in Britain. I recorded it in my 'Catalogue of Scottish Coleoptera' as found by myself in Scotland, but I am now satisfied that the specimen on which I relied was only a large variety of *nigricans*. If Erichson formed his opinion of the synonymy from not finding any other probable representative of *picipes* among Spence's species, the circumstance of its not being British explains how this may be. If he judged from Spence's description, he may have been misled by the commencing words used by Spence, "Body broader and more convex than in its congeners," which he might apply to *picipes*, which is the largest species in the genus; and by Spence's next words, "shorter than the preceding," viz. *nigricans*, he might have supposed him to mean less elongate in form, which *picipes* is, although certainly not actually shorter—it being longer. The only other resemblance to *picipes* is the black elytra; but Paykull's description of his *C. sericeus*, to which Spence refers as in all other respects identical with his, corrects this incongruity, for Paykull states the elytra of his species to be obscure testaceous. In Stephens's collection *sericea* is represented by a pale variety of *chrysomeloides*.

† No species has puzzled British entomologists more to identify than this. The prominence given by Spence and Stephens to the elevata form of the antennæ, and Spence describing it as bearing a close general resemblance to *chrysomeloides*, has had the effect of making most of them attempt to find a representative for it out of narrow-clubbed and small varieties of *chrysomeloides*—and accordingly it is generally so represented in British collections—an error which I have seen continental entomologists fall into in like manner. I cannot ascertain to my own satisfaction what the species was which Spence had in view in describing this. Mr. Waterhouse had adopted the usual British view, but Stephens has his *tristis* wholly represented by *fuscus*, Erichs.

‡ This species is stated by Erichson and Kraatz to be a synonym of *fuscus*, but from what I have already said in the note upon *sericea*, it appears to me that that synonym is preoccupied. Mr. Waterhouse has not this name represented in his collection. In Stephens's it is represented by two specimens of *tristis* and one of *grandicollis*. Little can be made out from Spence's description.

§ Represented wholly by *tristis* in Mr. Waterhouse's collection, and in Stephens's collection by two specimens of *tristis* and two of *grandicollis*.

|| Represented by *rotundicollis* both in Waterhouse's and Stephens's collections.

¶ Mr. Waterhouse has this represented by *morio*; in Stephens's collection it is represented wholly by *chrysomeloides*.

** Given as a synonym of *morio* by Erichson. Represented by *tristis*

*** *Antennæ clavate; posterior angles of thorax acute; elytra not striated.*

(*Anterior thighs alike in both sexes, the middle tarsi with the first joint rarely dilated.*)

C. villosa = *sericeus*, Fab. (*villosa*, Lat.) (*Ptomaphagus truncatus*, Steph.)

C. velox = *velox*, Erich.

C. fumata † = —? (probably *scitulus*, Erich.)

C. Watsoni = *fumatus*, Erich.

C. anisotomoides = *anisotomoides*, Sturm.

C. Wilkinii = *præcox*, Erich.

C. brunneus = *Colon* (*Mylaechus*) *brunneus*, auct.

The next author who went over the genus was Stephens. As he finally left it in his Manual, it contains all Spence's species, besides five of his own, and three which had been described by Mr. Newman in the 'Entomological Magazine,' between the commencement of the appearance of his 'Illustrations' and the publication of his 'Manual.'

in Waterhouse's collection, and by three specimens of *grandicollis* and one of *nigrita* in Stephens's collection.

† This name (*fumata*) has been universally applied to the species commonly known as the *fumatus* of Erich. and other authors, but a comparison of Spence's description of it and his next species, *Watsoni*, shows that the latter is what is now known as *fumatus*, and that the former is most probably *scitulus*, Erich. In his description of *Watsoni* Spence says, "In colour this species does not much differ from the preceding, but is furnished with other characters strikingly distinctive. The antennæ are shorter and thicker" (which is the case in the true *fumatus*). He also gives the last joint as pale, while he says nothing of this distinctive character in describing the preceding species. The rest of the description also corresponds with the view I have taken. I am perhaps wrong in using the expression "true *fumatus*." The *true fumatus* should by the rule of priority be what Spence had under his eye when he described it, but I think we are getting out of all bounds in our stickling for priority. If an author describes a species so loosely that it cannot be recognized from his description, so that subsequent authors misapply or ignore his name, while on their part they give a recognizable description, I cannot see on what principle of justice or propriety we are to be called upon to hold by the unrecognizable name instead of the recognizable, nor why an author (be he living or dead, or great or small) should be allowed to supplement his inadequate description by a reference to the typical specimens in his cabinet from which the descriptions were taken,—a practice now in vogue, against which I take this opportunity to enter my protest. Notwithstanding the claims of priority therefore, I do not propose to invert or disturb the generally adopted names of *fumatus* and *scitulus*. I have pointed out how the case obviously stands, and I leave to the advocates of priority the responsibility of introducing the confusion to which I demur.

The following is the result of my examination of the species standing named in his collection in the British Museum, viz. :—

Ptomaphagus truncatus = *C. sericeus*, Panz. (*truncatus*, Illig.)

— *velox* = *velox*, Spence.

— *fumatus* = *fumatus*, Erich.

— *Watsoni* = *fumatus*, Erich., and *scitulus*, Erich., mixed.

— *anisotomoides* = *anisotomoides*, Spence.

— *Wilkinii* = *præcox*, Erich.

Catops nigricans = *nigricans*, Spence.

— *sericea* = pale variety of *chrysomelooides*, Spence.

— *tristis* = *fusca*, Erich.

— *festinans*, represented by two specimens of *grandicollis*, Erich., and two of *tristis*, Erich.

— *affinis* = *nigrita*, Erich.

— *chrysomelooides* = *chrysomelooides*, Spence.

— *Leachii*, represented by two specimens of *grandicollis*, Erich., and two of *tristis*, Erich.

— *Kirbii* = *rotundicollis*, Kellner.

Ptomaphagus Spencei = *rotundicollis*, Kellner.

— *fulvicollis* = *velox*, Spence.

— *Marshami* = *chrysomelooides*, Spence.

— *dissimilator*, represented by three specimens of *grandicollis* and one of *nigrita*.

Choleva angustata = *angustata*, auct.

— *gomphoita* = ditto.

— *agilis*, represented by three specimens of *agilis* and two of *angustata*.

The other species, or names of species, given in his Manual are not represented in his collection.

I have not had an opportunity of seeing typical specimens of Mr. Newman's three species, *frater*, *soror*, and *nubifer*; but my friend the Rev. Wm. Little has in his collection specimens which had been named by Stephens as being the two latter, and if we may take that as an indication, we find that *soror* = *nigricans* and *nubifer* = *velox*.

Erichson's 'Käfer der Mark Brandenburg' followed in 1837. His division differs from that of Spence. It is as follows, viz. :—

Characters of the first division :—

" *Mesosternum simple* (without keel); body oblong; antennæ and legs long and thin, the former scarcely thickened at the point; legs slender; tarsi of fore-feet dilated in the males, tarsi of middle feet simple in both sexes."

This division corresponds to Spence's first section (Stephens's

Choleva) ; and Erichson only records two species found in Mark Brandenburg as belonging to it, viz. *angustatus* and *agilis*.

The characters of his second division are—

“ *Mesosternum simple* ; *tarsi slender*, and *anterior tarsi and first joint of middle tarsi dilated in the males*.”

These characters place the following species in this section, viz. *C. fuscus*, *umbrinus*, *picipes*, *nigricans*, *grandicollis*, *tristis*, *nigrita*, *fuliginosus*, *morio*, *fumatus*, and *scitulus*, of which *grandicollis*, *fuliginosus*, and *scitulus* are given as new. *Fuliginosus* is said by Kraatz to be a variety of *nigricans* (though, from the description alone, I should not have supposed this), and *scitulus*, as already mentioned, had been described by Spence under the name of *fumatus*. Erichson does not record *chrysomeloides* as found in Mark Brandenburg, but from the differences which he points out between it and *tristis*, I am not sure but some confusion exists even in Erichson relating to *tristis*.

His next division is characterized thus :—

“ *Mesosternum simple* ; *body oval* ; *antennæ somewhat thickened at the point* ; *tarsi slender* ; *anterior tarsi widened in the males* ; *middle tarsi simple in both sexes*.”

Velox and *præcox* (Spence's *Wilkinii*) are Erichson's only species falling under this division.

The last division has the

“ *Mesosternum keeled* ; *tarsi strong* ; *anterior tarsi in the males very broad, widened in the middle in the females* ; *middle tarsi of both sexes equal*.”

The only species recorded by Erichson is *sericeus* (*truncatus*, Illig. and Steph.).

The above list is instructive both negatively and positively, both for what it does and for what it does not contain. Erichson was celebrated not only for his marvellous acumen in distinguishing species, but also for his success in collecting and for the extent of his collection. Mark Brandenburg too may be taken as fairly representing the rest of Northern Germany ; and unless where the species are of a local character, we may pretty safely assume that the same species which occur in Mark Brandenburg will be found in the rest of Northern Germany. These premises should teach us to use great caution in admitting any new species from that district not described by Erichson, as they lead to the probable conclusion, first, that such new species might have been already found in Mark Brandenburg; secondly, that Erichson



might have seen them ; and lastly, might not have considered them distinct. Of course I do not make any further use of the great weight of his opinion, than to bespeak caution in determining upon such new German species as he has passed over.

Sturm next took up the group in his 'Deutschlands Fauna' in 1839. He added two new species to the first group (*Choleva*)—*spadiceus*, Dahl. *in litt.*, and *castaneus*, Andersch. *in litt.*—both of which have been adopted by subsequent authors, although, for reasons which I shall afterwards give, I think the latter is only a variety of *angustatus*. He also added the *badius* of Meg., the *brunneus* of Knoch, and the *anisotomoides* of Spence to the list of species found in Germany.

In 1841 Prof. Heer (in his 'Fauna Helvetica') described besides most of those already known, two new species, *montivagus* and *ambiguus*, and reproduced the *alpinus*, Gyll. The descriptions of the two former are too short and vague to allow of their being satisfactorily identified from the book, and I have not seen authentic specimens. M. Kraatz in his revision also states, that he has been unable to make them out, but holds that the *alpinus* of Gyllenhal has been rightly revived.

Several detached descriptions of individual species also appeared from time to time.

In 1832 a species from the Morea was described by Brullé in the 'Expédition Scientifique de Morée' under the name of *C. humeralis*, which seems to belong to the subgenus *Choleva*.

Chaudoir (Bulletin de Moscou, 1845, iii.) described two new species as being found in the neighbourhood of Vienna, *longipennis* and *sericatus*. M. Kraatz does not consider these to be distinct species, but joins them respectively to *nigricans* and *sericeus*.

Kellner in 'Stettin Ent. Zeit.' 1846, No. 6, described four new species, *C. longulus*, *rotundicollis*, *coracinus*, and *subfuscus*. As already mentioned, *rotundicollis* is the *Kirbii* of Stephens. Kraatz observes that *subfuscus* is not distinguishable from *alpinus*, Gyll. ; and from a specimen of *longulus* submitted to me by M. Kraatz, I am satisfied that it is only a variety of *tristis*.

Rosenhauer (Beiträge zur Insectfauna Europas) in 1847 described *C. abdominalis* (considered by Kraatz to be a variety of *tristis*) and *C. varicornis*, which, although very close to *sericeus*, appears to be a good species.

Redtenbacher in his 'Fauna Austriaca' (1849) gives a synopsis of the species of the genus, but without adding any new species. Dr. Aubé in 1850 added *C. meridionalis* and *quadraticollis*, besides *Catopsimorphus orientalis*, to the list. All three appear to be good species.

The only works remaining to be noticed are M. Kraatz's revision of the genus published in parts in the 'Stettin Ent. Zeitung' in 1852, and the 'Faune Entomologique Française' now in course of publication by MM. Fairmaire and Laboulbène. Although the latter work is subsequent in date, I shall notice it first; partly because none of M. Kraatz's new species are to be found in it, and partly because M. Kraatz's revision contains a full summary of all the European species hitherto described, and is therefore well suited for closing this part of my paper.

The authors of the 'Faune Ent. Franç.' adopt the name *Choleva*, Lat., in deference to priority, instead of *Catops*. They do not introduce any new species. They adopt the four subdivisions laid down by Erichson, and in addition attempt to break up the second subdivision into smaller sections. These subdivisions are—

1. "Posterior angles of corselet obtuse," in which they place *C. picipes*, *grandicollis*, and *alpina*.
2. "Posterior angles of corselet right-angled, more or less pointed," containing *C. fusca*, *morio*, *nigrita*, *quadraticollis*, *tristis*, *chrysomelooides*, *rotundicollis*, and *fumata*.
3. "Posterior angles of corselet pointed, a little produced behind," which contains *umbrina*, *nigricans*, and *scitula*.

These divisions appear to me to group the species in too unnatural a manner to be of service even as an artificial mode of arrangement in facilitating the determination of species. For instance, *picipes* in the first section has most affinity with *nigricans* in the third, *grandicollis* in the first with *tristis* in the second (indeed I propose to show presently that they are the same species); and *alpina* in the first has very close affinity with *fumata* in the second, and *scitula* in the third should join them. *Umbrina* undoubtedly ought to go beside *velox*, which is not in this section at all;—Erichson's character of the dilatation of the first joint of the middle tarsi in the males separating them. Their affinity otherwise however is so great, that I think that character must be disregarded to allow these species to take their proper place beside each other.

I now come to Kraatz's revision, in favour of which I cannot speak too highly. I differ from him in opinion in one or two instances, but wherever I do so I must beg the reader to take my opinion with caution and examine it with suspicion, as the well-known acumen and accuracy of that gentleman stamp his views with a *prima-facie* authenticity which only very strong evidence can overthrow.

He divides the genus into five sections, the first three and the last of which are Erichson's; the fourth is new.

In the first section he has *spadiceus*, a new species which he

calls *intermedius*, *angustatus*, *castaneus* (or *cisteloides*, Fröhl.), and *agilis*. In speaking of Sturm I have already expressed my opinion that *castaneus* and *angustatus* were varieties of the same species, and I cannot come to a different opinion as regards *intermedius*. When I go over the species *seriatim*, I shall give my reasons for this as well as for any similar views I may have adopted regarding other species.

In the second section he includes *acicularis* (a new species, which from the description seems distinct, but which I have not seen in nature), *umbrinus*, *fuscus*, *picipes*, *meridionalis*, *nigricans*, *coracinus*, *morio*, *nigrita*, *grandicollis*, *chrysomeloides*, *longulus*, Kelln. (which, as already mentioned, I think only a variety of *tristis*), *tristis*, *rotundicollis*, *neglectus* (a new species nearly allied to *tristis*), *alpinus*, *fumatus*, *brevicollis* (a new species which I have not seen, but which appears from the description to be good), and *scitulus*.

The third section is confined to *velox*, *badius*, *præcox*, *brunneus*, and *anisotomoides*.

The fourth section is characterized as follows, viz. :—

“ *Mesosternum* feebly keeled; body oblong, smooth and shining; antennæ strong, scarcely thickened towards the point; difference of sexes unknown.”

This section is erected by Kraatz to receive a single species named by him *lucidus*, and described from a single specimen found in Dalmatia.

The fifth section has received the greatest increase. Hitherto it had only contained the two species *sericeus* and *varicornis*, but Kraatz has added three new species, *strigosus*, *validus*, and *colonooides*. I have not seen *validus*, but the others appear to me good and distinct species.

Catopsimorphus orientalis he retains as forming a separate genus.

The number of exotic species which have been described is not great.

M. Motschoulsky described a species from Georgia, *C. pusillus*, in the Bulletins of the Imperial Society of Moscow for 1840.

Kolenati described in the ‘Meletemata Ent.’ a species, *C. fungicola*, from the Russian Province of Elisabethopoleos.

Menetries described a species (*C. pallidus*) from Bakon in the Caucasus in his ‘Catalogue raisonné des Objets de Zoologie recueillis dans un voyage au Caucase,’ &c. He also described in the Mem. Acad. Imp. Sciences de St. Pétersbourg, 6 sér. vi. 1849, two species, *C. lateritius* and *C. fuscipes*, found at Novaia Alexandrovskia.

Three species from Algeria, *C. marginicollis*, *C. celer* and *C. rufipennis*, have been described in 1849 by M. Lucas in the 'Exploration de l'Algérie.'

One species, *C. australis*, from Van Diemen's Land, has been described by Erichson in Wiegmann's 'Archiv für Naturgeschichte,' 1842.

The North American species hitherto described are *C. basilaris*, *C. opacus* and *C. simplex*, described by Say in the Journal of the Academy of Philadelphia, vols. iii. & v. ; *C. Spenciana* described by Kirby in the 'Fauna Bor. Americ.' ; *C. cadaverinus*, *C. Frankenhauseri*, *C. cryptophagooides*, *C. brunnipennis*, and *C. luridipennis* described by Mannerheim in the 'Bull. of the Imp. Soc. of Mosec.' in 1843, 1852 & 1853 ; *C. terminans* described by Leconte in Agassiz's 'Lake Superior,' and *C. clavicornis*, *C. californicus*, *C. strigosus*, *C. consobrinus*, *C. oblitus* and *C. parasitus*, described by the same author in the 'Proceedings of the Academy of Philadelphia,' 1853.

So much for the past history of the genus. We shall now proceed to the examination of the different species *seriatim*.

In doing so I shall first take the European species of each section, and then give the descriptions of the exotic species. I shall not attempt to intercalate the latter among the European species, because there are a number which I have not seen. I shall content myself with classing them according to their geographical distribution.

Genus CATOPS.

Mentum square, transverse, a little narrowed in front. Ligula of the breadth of the mentum at its base, widened and deeply emarginate in front. *The internal lobe of the maxillæ terminated by a corneous nail or hook.* The maxillary palpi decidedly larger than the labial ; their third article formed like a reversed cone, the fourth much more slender, conic and acuminated. The third article of the labial palpi oval, a little longer than the second. Mandibles short, furnished with a molar tooth at their base, arched, sharp at the end and unidentate before their summit. Labrum short, rounded, and a little sinuated in the middle in front. Head declining, obtuse in front. Eyes nearly rounded, moderate in size and not prominent. *Antennæ* at least of the length of the thorax ; their first six articles of variable length, subcylindric, the last five forming a club, which is sometimes so elongated and slender as to be scarcely observable, and sometimes very distinct ;

the eighth joint shorter than the seventh and ninth. Prothorax of variable form. Elytra oblong or oval, arched above. Legs long and slender, the first four joints (and more especially the first two) of the anterior tarsi, and sometimes the first joint of the intermediate tarsi, dilated in the males and provided with brushes of hair below. Mesosternum sometimes keeled. Body oblong or oval, clothed with a very fine silky pubescence*.

The first division which I shall adopt is the same as Erichson's, and I preserve Latreille's name *Choleva* for it as a subgenus; but I shall drop the dilatation of the anterior tarsi and the first joint of the middle tarsi in the males as a character.

It is a detraction from any character that it requires an examination of both male and female to recognize it; and although the character is perfectly true in this group, it cannot be used in contrast to the subsequent divisions which I am going to propose, as in them exceptions to such a rule occur. I think the following short characters sufficient.

Group I. (Subgenus CHOLEVA.)

Mesosternum not keeled; body oblong; antennæ almost filiform; legs long and thin, posterior trochanters more or less developed in the males.

1. *C. angustatus*, Fab.

Cistela angustata, Fab. Syst. El. ii. 20. 23.

— *agilis*, Fab. Syst. El. ii. 20. 27.

Catops elongatus, Payk. Faun. Suec. i. 345. 3; Gyll. Ins. i. 281. 6.

Ptomaphagus rufescens, Illig. Käf. Pr. 87. 1.

Catops rufescens, Duft. Faun. Aust. iii. 72. 1?

Choleva oblonga, Lat. Gen. Crust. et Ins. ii. 27. 1; Spence, Linn. Trans. xi. 138. 1.

Catops angustatus, Erich. Käf. d. Mark Brand. i. 233. 1; Sturm, Deutschl.

Faun. xiv. 5. 1. taf. 272. M. m; Heer, Faun. Helv. i. 378. 1; Redtenb.

Faun. Aust. 143. 4; Fairm. & Laboulb. Fn. Ent. Franç. i. 299. 1.

Oblongus, fuscus vel nigro-piceus; thorace postice non latoire; elytris substriatis; antennis pedibusque ferrugineis.

Long. $2\frac{1}{2}$ lin.

A long thin species. The head dark, the parts of the mouth and the antennæ ferruginous; the latter about the length of the elytra, the eighth joint a little smaller than the ninth, the last joint long and acuminate. The thorax is variable in form, sometimes widest at the middle, as in fig. 1, sometimes widest a

* This description of the characters of the genus is copied with some modifications from that given by Prof. Lacordaire in his admirable work the 'Genera des Coléoptères.'

little before the middle, as in fig. 2, and sometimes widest at the very front, as in fig. 3, but *never widest behind*; sometimes a little

Fig. 1.



Fig. 2.

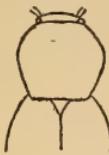


Fig. 3.



broader than long, and sometimes about equal in length and breadth. The sides are rounded. In some examples they are semitransparent or paler than the centre (and are then known as the var. *angustatus*). In others the edges are firm and concolorous (the variety *castaneus*). The posterior angles are nearly right-angled, more or less obtuse. The upper side is very densely and finely punctate in the males, less so in the females, and in both covered with a thin pubescence. The elytra are feebly striated, finely and densely punctate, with a fine pubescence, sometimes rounded, sometimes acuminate at the apex, sometimes wholly ferruginous, sometimes dark chestnut, paler round the borders. The under side is brown, the edges of the abdominal segments and sometimes the apex of the abdomen reddish. The legs ferruginous.

The trochanters and thighs of the hind legs are liable to considerable variation in form in the males. The following varieties are met with.

1. The trochanters are simple, and the thighs have a fine tooth below.

2. The thighs are simple, and the trochanters are armed with a sharp spike.

3. The thighs are simple, and the trochanters lengthened, formed like a gouge-chisel, convex outwards, concave inwards, but with the edge turned inwards at the point.

4. Both thighs and trochanters simple.

It will be seen from the above that I consider this a variable species, and that the variations I have above indicated are nothing more than different forms of the same species. Erichson was of the same opinion, for it was he who first observed and recorded the variations in the form of the trochanters of the hind legs, and in noticing them he remarks—"Of the males I have the following variations before me. These, one cannot with propriety refer to different species, when in all other respects the perfect examples agree." Other authors however have come to a different opinion, and have made distinct species of these different varieties, and as these authors are of high standing and their

species have been very generally adopted, it will be right, I think, to give a copy of their descriptions, so that the reader may have before him the means of judging for himself.

I shall therefore quote the descriptions of them given by Kraatz, as being both the most recent and the most ample; but, in accordance with my own opinion, I shall rank them here only as varieties.

Var. *C. angustatus*, Kraatz.

Catops angustatus, Kraatz, Stett. Ent. Zeit. xiii. 401. 3.

“ Oblongus, piceus; thorace minus dense et subtiliter punctato, ante medium latiore, angulis posticis obtusiusculis, marginibus et angulis posticis dilutioribus; elytris substriatis, rufo-ferrugineis, versus suturam postice interdum infuscatis.

“ Long. $2\frac{1}{2}$ lin.

“ *Mas*, trochanteribus posticis plerumque scalpiformibus.

“ *Fæm.* ? elytris apice acuminatis.

“ The longest and narrowest species in this group. The antennæ are very slender, longer than the half of the body, *always entirely of a clear ferruginous colour*. First joint somewhat stronger and as long as the second; third nearly twice as long as the joints on each side of it (second and fourth); eighth only a little shorter than the seventh and ninth, which are equal in length; the last joint longer than the preceding, long, cylindrical, and acuminate. The head is blackish brown; the parts of the mouth ferruginous, abundantly and finely punctate. The thorax is a little broader than long, gently rounded at the sides, broadest before the middle, gradually narrowed towards the base, the posterior angles more or less feebly obtuse-angled; the basal margins are depressed for a moderate breadth, and somewhat bent up, so that there is the commencement of a deepened line on each side. The upper side is covered with a moderately dense golden-yellow pubescence, and *tolerably abundantly and finely punctured, pitchy black, the outer edges and the posterior angles reddish brown*, with a more or less distinctly marked dorsal line, slightly impressed on both sides near the base. The elytra are only very feebly expanded, sometimes not wider than the base, pressed flat at the suture, slightly striated, finely and densely punctate, with a fine silken pubescence, ferruginous. The darker individuals are somewhat darker towards the apex near the suture. The legs are ferruginous red.

“ Note I.—A not unimportant sexual distinction in this and the kindred species is afforded by the formation of the posterior trochanters. I have already (Stett. Ent. Zeit. xii. p. 284 ff.) ex-

pressed my opinion upon them, but by persevering investigations I am now able to add something to what has been already said, by way of completion. Male examples both of *C. angustatus*, Fab., and *C. cisteloides*, Fröhl. (*castaneus*, Sturm), occur with slightly developed simple acuminate posterior trochanters, with the difference however, that the trochanters in *C. angustatus* are narrower and longer than in *C. cisteloides*, and their point is far more acuminate. But there are moreover in both species males with very different, strongly developed trochanters. Nevertheless the principle of development is wholly different in the two species. The highest step of the development of the trochanters in the *C. cisteloides*, is that they are armed at the inner side with a projecting tooth more or less curved, and in the *angustatus*, that they are widened and lengthened into a gouge-chisel form; thus it is clear that a male of the *angustatus* can never come before us with a tooth at the inner side of the trochanter, it being impossible to form a transition-step to the gouge-chisel form.

“Note II.—I think I have found a second interesting sexual distinction of the females of the *C. angustatus*, F., in the single sharp acuminate posterior angles of the elytra. The specimens of Erichson (to be found in the Royal collection of this place (Berlin)) are represented as females of *C. angustatus*; in the same way a collection of females here agree perfectly with the males, but the latter have rounded elytra. One female taken at Cassels (alas, somewhat injured), which has been kindly surrendered to me by Herr Richl, has likewise acuminate elytra. A larger series of this generally rare species would be required to allow us to decide without doubt whether perhaps one of the species very similar to *C. angustatus* exists, of which the male likewise may have acuminate elytra. However, I consider this highly improbable.

“Note III.—From the near affinity of this species with the following species more minutely described by Sturm (*castaneus*, St.), is it surprising that I yet refer to this species the greatest part of those placed by Erichson under the *C. angustatus*, of the authors referred to by him, without subjecting to a more particular examination the descriptions given by them, and knowing whether or not they had the work of Sturm on *Catops* before them while engaged on their descriptions? Such an examination has been made as far as possible, and leads to the result that those authors who entered upon a more detailed description, such as Gyllenhal, Latreille, Spence, had mostly both species before them, as Gyllenhal without doubt appears to have had.”

Var. *C. intermedius*, Kraatz.

C. intermedius, Kraatz, Stett. Ent. Zeit. xiii. 401. 2.

“ Oblongus, fuscus; thorace postice angustiore, ante medium latiore, angulis posticis obtusiusculis; elytris substriatis concoloribus; antennis pedibusque ferrugineis.

“ Long. $2\frac{1}{2}$ lin.

“ *Mas*, trochanteribus posticis scalpiformibus.

“ In form this species occupies the middle place between *C. spadiceus*, Dahl., and *angustatus*, Fab.,—shorter and broader than the latter, less robust than the former; well distinguished however by its breadth. It is distinguished at the first glance from *C. spadiceus*, Dahl., by the thorax not being deeply and strongly punctured, as well as by its lighter colour. From *C. angustatus* it differs in the following points:—

“ *a*. The whole beetle is shorter, more compressed, less equally broad than the *C. angustatus*, Fab.; the elytra in the middle somewhat bellied out.

“ *b*. The antennæ are likewise uniform in colour, clear ferruginous red, but somewhat shorter and stronger, the eighth joint relatively shorter than in *C. angustatus*.

“ *c*. The margin of the thorax is somewhat broader, and more bent upwards than in the *C. angustatus*, Fab.; it is also to be distinguished by the deepened lines on each side of the thorax. *The upper side is moderately finely and densely (coarsely-shagreen) punctured, ferruginous brown, occasionally somewhat darker in the middle.*

“ *d*. The elytra are less equally broad than in the *C. angustatus*, Fab., in the middle somewhat bellied out, entirely of one colour, ferruginous brown.

“ I have at least half-a-dozen females, but only one male before me, which with greater probability belongs to this species. It has gouge-chisel-shaped lengthened trochanters in the hinder legs.

“ This species has up to this time been collected in the island of Rugen (Erichson!), Königsberg (Hargen!), Leipzig (v. Kiesenwetter!), S. Wehlen (Märkel!), and Düsseldorf (Hildebrand!). It has also been taken in Austria. For the most part it is found under leaves. *C. angustatus*, Fab., is not rarely found under stones.”

Var. *C. cisteloides*, Fröhl.

“ *Luperus cisteloides*, Fröhl. Naturf. 28. 25. 3. t. 2. f. 50.

“ *Catops castaneus*, Sturm, Ins. xiv. 9. 3. t. 273. *a. A*; Heer, Fn. Helv. i. 378. 2; Redt. Fn. Aust. 143. 4; Kraatz, Stett. Ent. Zeit. xii. 284. 4.

“ — *cisteloides*, Kraatz, Stett. Ent. Zeit. xiii. 404; Fairm. & Laboulb. Faun. Ent. Franç. i. 299.

“ Oblongus, nigro-piceus ; thorace nigro-piceo, ante medium vix latiore, angulis posticis obtusiusculis ; elytris substriatis, piceis seu castaneis.

“ Long. $2\frac{1}{2}$ lin.

“ *Mas*, trochanteribus posticis acuminatis seu latere inferiore dente magis minusve curvato extante.

“ This is readily distinguished from the *C. angustatus*, Fab., by the darker colour and the form of the thorax. The antennæ are nearly as long as the body*, reddish brown, always darker towards the point. First joint strong, third distinctly longer than the contiguous joints, the fourth somewhat shorter than the third ; fifth, sixth and seventh equal in length, eighth nearly half as long as the seventh, ninth somewhat shorter than the seventh, tenth somewhat shorter than the ninth ; the last joint almost twice as long as the preceding, sharply acuminate. The head is black-brown, extremely finely and closely punctate. The thorax is formed like that of *C. angustatus*, Fab., but the sides both before and behind are nearly equally strongly rounded, so that the greatest breadth is not before the middle ; the margin is by far less raised up, less broadly spread out, so that the line on each side of the thorax is both shorter and less deeply marked ; *the upper side is as a rule entirely pitchy black, extremely deeply and finely (fine-shagreen) punctured* ; the deep middle line is frequently wanting. The elytra are moderately arched, lightly striated, *pitchy black, more rarely pitchy brown*. The legs are ferruginous brown.

“ It is spread over the whole of middle and southern Europe, and not rare. In France (according to Latreille) ; in Lombardy (according to Villa) ; in Italy (according to Sturm) ; in Sardinia (Géné, Berlin Mus.) ; in Sicily (Berlin Mus.).”†

A consideration of the differences here given as characterizing these three species will not, I think, warrant us in looking upon them as more than varieties.

The differences consist in the form and colour of the thorax, the punctuation of the thorax and elytra, the form and colour of the body, the colour of the antennæ, the proportions of the joints of the antennæ, and the form of the posterior trochanters.

Of these, the difference most readily recognizable is that in the form and colour of the thorax ; the form of the thorax in the *typical* specimens of *C. castaneus*, Sturm, being that shown in fig. 1, while *C. angustatus*, Fab., is that shown in fig. 2, and *C. intermedius*, Kr., somewhat between them, but nearest to

* This is not correctly expressed. The antennæ are longer than the half of the body, but cannot be said to be “nearly as long as the body.” They are in no degree longer than the antennæ of the other varieties.

† Kraatz in *loc. cit.*

fig. 2. M. Kraatz's description might lead us to suppose that fig. 3 would best represent *C. angustatus*, F., but having had under my eyes typical examples of all three, sent to me by M. Kraatz, I find that none of them have the thorax widened more in front than fig. 2, which, indeed, fairly represents the thorax of M. Kraatz's specimens of *C. angustatus*, F. But I know that there *are* examples which have their thorax widened as much in front as fig. 3. I possess one myself, and Sturm gives that form in his figure of his *C. angustatus*. We must therefore either make a fourth species to receive fig. 3, or else admit that this subgroup is variable in the form of its thorax; and there need be no hesitation in adopting the latter course, as, although I have not met with any specimen exactly filling up the gap between fig. 2 and fig. 3, I have seen all grades of transition between fig. 1 and fig. 2. Another point of difference, where we constantly see a gradual passage between the one and the other, is the colour of the thorax. In the typical *C. castaneus*, St., it is dark pitchy black throughout, and the margins are not paler than the centre, nor semitransparent. In both *C. angustatus*, F., and *C. intermedius*, Kr., the margins are paler, or semitransparent; but I have seen transition specimens where it is almost impossible to say whether the margins are paler or not, in one view looking paler, and in another quite dark and opaque. Again, specimens occur very slightly paler on the margins, and so on. The punctuation and depressions, and the spreading out and raising up of the margins of the thorax also vary. I admit that I have never seen the normal or perfect examples of *C. castaneus*, St., with the spread-out and slightly bent-up edges of the *C. angustatus*, F., or *intermedius*, Kr.; but if, as I imagine, the latter are less mature individuals, and *castaneus*, St., the more mature fully-coloured and more solidified form, such a circumstance will sufficiently account for the differences to which I have been alluding, whether in punctuation, depression, or colour. Indeed, such a supposition accounts for more; for it is not only in the thorax that these differences exist, but also in the whole of the rest of the body. *C. castaneus*, St., is darker and more deeply punctate on the elytra also, and the deeper colour extends to the antennæ, which are slightly darker at the point; and this is only what might be expected: we always find that where a greater infusion of colour has penetrated through an individual, it is not confined to one part, but pervades the whole system. I also look upon the acuminate sutural apex of the elytra (referred to by Kraatz as being possibly a sexual distinction of *C. angustatus*, F.) as another indication of immaturity. I have never seen this in *C. castaneus*, St., but I have found it indifferently both in the males and females of *C. angustatus*, F. As to

the differences in the form of the joints of the antennæ of *C. angustatus*, F., and *castaneus*, St., these are too slight, even adopting absolutely M. Kraatz's own description, to allow us to use them as characters for a species; but I cannot entirely adopt his descriptions without reservation, as, notwithstanding a very careful examination of the specimens he sent me, I have scarcely been able to detect the differences he alludes to. Turning back to his description, it will be seen that the only differences given are the following:—In *C. angustatus*, F., he says, the third joint is nearly twice as long as either the second or fourth. In *C. castaneus*, he says, the third is distinctly longer than either the second or fourth. In *angustatus* the seventh and ninth are said to be equal in length. In *castaneus* the ninth is somewhat shorter than the seventh. In *angustatus* the last joint is said to be "longer than the preceding, long cylindric and acuminate." In *castaneus* it is "almost twice as long as the preceding, sharply acuminate." The differences here given are thus exceedingly minute, so much so as to be inappreciable by an ordinary observer. Now I know that in undisputed species in this genus considerable differences are to be perceived in different individuals in the relative thickness, &c. of the joints of the antennæ; so much so as to make the antennæ appear decidedly more clubbed in the one than the other. This minute measuring of the joints appears to me therefore an unsafe character, not to be adopted. There only remains the difference in the form of the posterior trochanters in *C. angustatus*, F., and *castaneus*, St. On this I shall only observe, that M. Kraatz admits that there is great variation in the development of these parts, but seems to think there is an impossibility in a transition taking place between a trochanter having a projecting curved tooth at the inner side, and a trochanter itself of a gouge-chisel-shaped form without a tooth on the inner side. My readers must judge for themselves as to this; but I agree with Erichson in thinking that the development of that part is variable, and I cannot agree with M. Kraatz in putting bounds to the variation.

The differences we have been considering are almost entirely those between *C. angustatus*, Fab., and *intermedius*, Kr., on the one part, and *C. castaneus*, St., on the other. It is much more difficult to point out those between *C. angustatus*, F., and *intermedius*, Kr.: as to these, I shall confine myself to referring the reader to the distinctions pointed out by M. Kraatz himself in his description of *C. intermedius* above quoted, merely observing that if I am right in joining together the much more dissimilar forms of *C. angustatus*, F., and *castaneus*, St., we can have no hesitation in refusing to make another species on the strength of the almost imperceptible differences relied on by

M. Kraatz, a decision which a careful examination of the specimens of *intermedius* so kindly furnished to me by that gentleman has given me no reason to alter. If any of the varieties are to be exalted into separate species, *castaneus*, St., is obviously the one best entitled to this.

Referring back then to my general comprehensive description of this species above given (p. 13), I have only to add, that the extreme examples of the foregoing varieties may be known without much difficulty by the following characters. The less decided examples form intermediate steps, and it will often be found scarcely possible to say to which of the nearest varieties they belong.

1. *Pale ferruginous varieties.*

Var. A. Thorax widest at front, as shown in fig. 3; margins paler than centre.

Var. B. C. angustatus, Kraatz. Thorax widest not at the very front, but a little before the middle, as in fig. 2; margins paler than centre; depressions on thorax not deep. Elytra nearly parallel, darker at suture towards apex.

Var. C. C. intermedius, Kraatz. Thorax a little broader than in var. B; margins paler than centre, with deeper depressions on thorax. Elytra slightly widened in middle, entirely red ferruginous.

2. *Dark chestnut variety.*

Var. D. C. castaneus, Sturm. Thorax widest in middle, as shown in fig. 1, of a more solid consistence than the pale varieties; margins not paler than centre.

This species is found over the whole of Europe, and Gebler mentions it as having been taken in the south-west of Siberia. The whole of the above varieties are found in England and Scotland, but var. D is the commonest and var. A the rarest—(of it I have only seen one example).

2. *C. spadiceus*, Sturm.

Catops spadiceus, Dahl. in lit.; Sturm, Ins. xiv. 11. taf. 273. fig. 6 B; Redt. Fn. Aust. 771; Kraatz, Stett. Ent. Zeit. xiii. 399.

Fig. 4.

Oblongus, nigro-piceus; thorace fortius punctato, postice angustiore, ante medium latiore, angulis posticis obtusis; elytris castaneis, parum ventricatis, apice obscurioribus, substriatis; antennis ferrugineis, apicem versus obscurioribus.

Long. $2\frac{1}{4}$ - $2\frac{1}{2}$ lin.

Mas, trochanteribus posticis scalpiformibus.



The most robust species in this group. Head, thorax and under-side in the fully-coloured individuals pitchy black, the elytra fine chestnut-brown. The examples not fully coloured are dirty yellowish brown. The antennæ are tolerably long, scarcely half as long as the body, reddish brown, in the normal state *the last five joints darker*; the first somewhat stronger, third somewhat longer than the adjoining joints; second, fourth and fifth of equal length; sixth somewhat shorter than the fifth, and as long as the seventh and ninth; eighth somewhat shorter than the tenth; tenth somewhat shorter than the ninth; *the last joint is somewhat shorter than the foregoing*, strongly acuminate. The head is pitchy black, the parts of the mouth ferruginous red; the top of the head finely and sparingly, the front more deeply and strongly punctured. The thorax is distinctly narrower than the elytra, a little arched, somewhat broader than long; the sides rounded, and somewhat more so in front than behind, so that the greatest breadth of the thorax is rather before the middle; the posterior angles are obtuse and rounded off, the basal margin straight-truncate; the margin in the posterior half is broadly expanded and a little bent up, so that a somewhat bent and deep line arises on each side, particularly when seen from above. *The upper side is strongly and deeply punctate**, moderately densely covered with a golden-yellow pubescence, with a distinctly impressed line along the middle, about one-third of the thorax in length. The scutellum is triangular, punctate, brown. The elytra are *moderately arched*, chestnut-brown, and a little darker towards the apex; immediately behind the shoulders and a little further back somewhat *bellied out*, but not so that the greatest breadth lies before the middle. The striae are moderately shallow, but very distinct, and their punctuation is proportionately strong and somewhat wrinkled. *The pubescence on the elytra is long, and not so close or adpressed as in the allied species.* The legs are ferruginous brown.

Kraatz records the male as having chisel-formed posterior trochanters, but in strongly developed specimens there might easily occur gouge-formed trochanters. Sturm only knew the female. I have also only seen the female.

This species is to be distinguished from the preceding by its more robust form, deeper punctuation, more bellied elytra, and by the longer pubescence on the elytra. For a considerable time I was disposed to look upon it as merely another variety of *C. angustatus*, F., but I am now satisfied that it may justly take

* Sturm says, "finely and densely" punctate, but Kraatz properly corrects this; the deep coarse punctuation being one of the most characteristic features of the species.

its place as a distinct species. The stronger punctuation taken by itself might only indicate a variety, but the bellied form of the elytra and the difference in the pubescence are more essential characters ; the latter is particularly well seen on the edges of the elytra.

It was first recorded by Sturm as having been found in Austria and Hungary. Chaudoir found it at Kiew. Kraatz records it as having been taken at Halle, Bautzen, Erlangen, Darmstadt, &c. It has been taken by M. Chevrolat in France, and I have one specimen taken in Scotland. Kraatz says, it is generally found under leaves.

3. *C. humeralis*, Brullé.

Choleva humeralis, Br. Exped. Sc. de Morée, iii. p. 162. no. 255.

“ Nigricans, punctatus, rufo-villosus ; ore, antennis, elytrorum macula humerali, abdominis segmentorum marginibus pedibusque ferrugineis ; antennis apice fuscis ; elytris profunde punctato-striatis.

“ Long. $2\frac{1}{2}$ lin., lat. $1\frac{1}{4}$.

“ Head black, finely punctate, with the whole of the mouth and the half of the antennæ ferruginous ; the latter slightly pubescent, their five last articles brown. Thorax a little less long than broad, rounded on the sides, raised at the posterior angles, truncate behind, finely punctate, of a blackish brown, lighter on the lateral margins, and covered with a short reddish pubescence. Scutellum triangular, blackish and pubescent like the thorax. Elytra oval, a little broader than the thorax, marked with deep longitudinal striæ formed by large deep punctures, and tolerably strongly punctate in the intervals between the striæ ; their colour is of a deep brown, marked with a large ferruginous blotch at each of the anterior angles ; they are covered by a reddish adpressed and tolerably dense pubescence. Under side of the body finely punctate, blackish, with the edges of the abdominal segments ferruginous. Legs of this latter colour ; posterior thighs partly brown.

“ Upon flowers in the month of June. Arcadia*.”

This appears to be the proper place to take in this species. I have not seen it. Brullé did not give a figure of it in his work, and on inquiry at Paris I find that his specimens must have been eaten by the larvæ of the *Anthreni* so destructive to collections on the continent. The only trace or record of the species, therefore, so far as I know, is his description, of which

* Brullé in *loc. cit.*

the above is a translation, and which seems to me to show considerable affinity to the preceding species (*spadiceus*, St.).

4. *C. agilis*, Illig.

Ptomaphagus agilis, Illig. Käf. Pr. 882.

Choleva agilis, Spence, Linn. Trans. xi. 1402.

Catops fuscus, Gyll. Ins. Suec. i. 281. 5.

Choleva testacea, Latr. Gen. Crust. et Ins. xi. 28. 2.

Catops agilis, Erich. Käf. d. Mark Brand. i. 234. 2; Sturm, Ins. xiv. 7.

2. tab. 272. n. N; Heer, Fn. Helv. i. 379. 3; Redt. Fn. Aust. 133. 3; Kraatz, Stett. Ent. Zeit. xiii. 405; Fairm. & Laboulb. Fn. Ent. Franç. i. 300.

Oblongo-ovatus; nigro-piceus, vel testaceo-piceus;
thorace transverso, postice latoire; elytris sub-
striatis, antennis pedibusque ferrugineis.

Long. $2\frac{1}{4}$ lin.

Mas, tibiis mediis curvatis; trochanteribus posticis
inferiore dente curvato acuminato armatis.

Fig. 5.



Shorter and somewhat broader than *C. angustatus*, Fab., not very constant in colour, the darkest examples ferruginous brown with lighter antennæ. The antennæ are scarcely half so long as the body; the third joint almost twice as long as the second; the fourth, fifth and sixth are nearly equally long, the remainder (seven to eleven) are somewhat stronger than the preceding; the eighth is half as long as the ninth; the ninth equal to the tenth; the last joint is a half longer than the preceding joint, obtusely acuminate. The head is brown, extremely fine and tolerably sparingly punctured. The thorax is almost twice as broad as long, nearly of the breadth of the elytra, narrower in front than behind, the broadest part being decidedly behind the middle; the posterior angles are obtuse and rounded, and the sides are neither spread out nor bent up, so that the moderately dense and very finely punctate upper side is entirely smooth. The colour of the thorax is dark ferruginous brown, darker in the middle. Individuals with the thorax entirely blackish occur rarely. The elytra are generally ferruginous or testaceous, sometimes chestnut and sometimes pitchy brown; they are finely and densely punctate; at the base very feebly, towards the apex more distinctly finely punctate striate. The legs are ferruginous brown, the middle tibiae of the males are bent strongly inwards, the posterior trochanters are not distant at the base, and are armed on the inner side with a short strong pointed tooth.

This species is readily distinguished by the form of the thorax, narrowest in front and widest behind. The other particulars which I have printed in *italics* are characters also easily seized.

It is spread over the most part of Europe, in Prussia, Austria, Saxony, Switzerland, France, Sweden, and Britain, but is everywhere scarce.

The only exotic species belonging to this group which I know of is *C. lateritius*, Menet. *C. Frankenhaueseri*, Mann., would also fall into this group, if it is retained in the genus at all, but its pectinate antennæ seem to me to require us to create a separate genus to receive it.

5. *C. lateritius*, Men.

Catops lateritius, Menetries, Mem. Acad. Imp. Sciences, St. Petersburg, 6 sér. vi. (1849), p. 52.

“ Oblongo-ovatus, pallide rufo-ferrugineus, breviter griseo-pubes-
cens ; antennis tenuibus longitudine dimidii corporis ; thorace
transverso subdepresso postice latiore angulis obtusis, late-
ribus subreflexis ; elytris creberrime punctulatis, substriatis,
stria suturali profunde exarata.

“ Long. 2 lin., lat. $\frac{5}{4}$ lin.

“ Near *C. agilis*, Illig., but proportionately narrower, the thorax is much less broad and flatter, and the antennæ are much longer.

“ Described from two individuals taken at Novaia Alexandrovskaya*.”

Group II. (Subgenus CATOPS (true).)

Mesosternum not keeled ; body oblong ; antennæ more or less club-shaped or thickened towards the apex, eighth joint decidedly smaller than seventh and ninth. The posterior trochanters not more developed in the males.

1st Subdivision. *Base of thorax decidedly narrowed or cut in, so that the thorax and elytra do not form a continuous outline. Middle tarsi widened in the males.*

6. *C. acicularis*, Kraatz.

Catops acicularis, Kraatz, Stett. Ent. Zeit. xiii. 406. 6.

*Oblongus, ferrugineus ; antennis subfiliformibus ; thorace trans-
verso, postice latiore, angulis posticis obtusiusculis ; elytris
substriatis transversim strigosis.*

Long. $1\frac{5}{4}$ lin.

Of the slender form of the species in the foregoing group, but

* Menetries in *loc. cit.*

proportionally not so elongate ; ferruginous brown ; easily distinguished from the remaining species of this group by its transversely strigose elytra. The antennæ are slender, reddish brown, not quite so long as the elytra ; first joint somewhat shorter than the second ; second equal to the third ; third equal to the fifth ; fourth somewhat longer and stouter than the sixth ; eighth only one-third of the length of the seventh, and somewhat narrower than those on each side of it ; ninth somewhat shorter than the seventh, almost somewhat stouter, and equal to the tenth ; eleventh of the stoutness of the preceding, about half as long, from the middle forward cone-shaped acuminate. The head is densely and finely punctate, pitchy-black. The thorax is nearly of the breadth of the elytra, wholly light, twice as broad as long, slightly arched, the sides wholly rounded, somewhat more strongly behind than in front, so that the greatest breadth is behind the middle ; the anterior angles are somewhat bent down, strongly rounded, the posterior angles are obtuse-angled. The basal margin is extremely lightly sinuated on both sides towards the scutellum ; the upper side of the thorax is moderately densely and finely shagreen-punctured. The elytra are uniform oblong, gradually narrowed towards the apex, each being rounded ; they have feeble traces of longitudinal striae, and besides are transversely strigose almost parallel with the base of the thorax. The legs are ferruginous brown and slender.

I have not seen this species in nature, and have merely copied M. Kraatz's description. It appears to be readily recognized among its neighbours by its transversely strigose elytra. It is found in Sicily, and appears to be rare, M. Kraatz having only seen three specimens.

7. *C. fuscus*, Panz.

Helops fuscus, Panz. Fn. Germ. 18. 1.

Luperus fuscus, Fröhl. Naturf. 28. 24. 2. t. 1. f. 16.

Catops sericeus, Payk. Fn. Suec. i. 342. 1.

Catops rufescens, Fab. Syst. El. ii. 563. 1.

Choleva sericea, Spence, Linn. Trans. xi. 145. 6.

Catops festinans, Gyll. Ins. Suec. iv. 314. 1-2.

Catops fuscus, Erichs. Käf. d. M. Br. i. 235. 3 ; Sturm, Deutschl. Fn. xiv.

13. 5. t. 274. f. a. A ; Heer, Fn. Helv. i. 379. 4 ; Redt. Fn. Austr. 164.

11 ; Kraatz, Stett. Ent. Zeit. xiii. 407. 8 ; Fairm. & Laboulb. Fn. Ent. Fr. i. 101. 7.

Breviter ovatus, *fuscus* ; antennis subfiliformibus ; thorace transverso, postice latiore, angulis posticis rectis ; elytris rufo-brunneis, substriatis.

Long. 2 lin.

Dark brown, short oval. Antennæ ferruginous brown, very feebly thickened towards the extremity, not quite so long as the head and thorax; first joint longer than the succeeding joints; second very little shorter than third; third and fourth very nearly equal; fifth and sixth equal, both a little shorter than fourth; seventh not much if at all longer than sixth, but a good deal broader; eighth shorter than those on each side of it, but not greatly narrower; ninth and tenth about same size, and eleventh acuminate and nearly twice as long as the tenth. Head and thorax black, very densely punctate, with a yellowish grizzly adpressed pubescence; mouth reddish; edges of thorax ferruginous brown. *Thorax* rounded on the sides, *broadest behind the middle*, at the base almost twice as broad as long, *very slightly rounded in at the posterior angles*, which are right-angled and have a slight tendency to project behind. *Elytra* reddish brown, covered with a bluish-grey bloom; a little widened in the middle, *apex almost acuminate*; densely punctate, and with striæ visible towards the apex, scarcely perceptible in front. Legs reddish brown.

This species is easily distinguished from the rest of the section by the breadth of its thorax behind, which gives its outline at first sight, and before the junction of the thorax and elytra is examined, very much the appearance of being a continuous oval slightly interrupted at the base of the elytra.

It is widely distributed, being found both in England and Scotland, France, Germany, and most of Europe. Kraatz says that it is seldom or never found under leaves or fungi, but in cellars, stables, potato-heaps, &c. Fairmaire and Laboulbène mention it as having been also taken in moss at the roots of trees. Stephens gives "carcasses" as its habitat, and rightly enough so far as regards the species he has under this name (viz. a pale variety of *chrysomeloides*), but incorrectly as regards the true *fuscus*. It is, however, easy to predicate of each species by a simple inspection of its antennæ whether it is a carcase-feeder or not. Those species with filiform or slightly thickened antennæ are found among leaves and moss, &c. Those with heavy, thick, clubbed antennæ are found under dead birds or small mammals. In other words, those which have to seek out putrescent matter for their food, or a nidus for their eggs, are furnished with largely developed antennæ to enable them to smell it out.

Fig. 6.



8. *C. meridionalis*, Aubé.

C. meridionalis, Aubé, Ann. Soc. Ent. Fr. viii. 326. 34. t. 11. f. 2; Kraatz, Stett. Zeit. xiii. 428. 10.

Ovatus, convexiusculus, piceus; antennis pedibusque ferrugineis; thoracis angulis posticis valde productis; elytris oblongiusculis, striatulis.

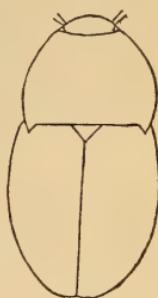
Long. $2\frac{3}{4}$ lin.

Pitchy-brown; in general appearance occupying the middle between *fusca*, Panz., and *picipes*, Fab. Head black and finely punctate. Antennæ and palpi ferruginous; antennæ of the length of the head and thorax, only feebly thickened towards the point; first joint equal in length to the third, and nearly twice as long as the second; fourth equal to the fifth, also to the sixth, and somewhat shorter than the third; seventh equal to the second, yet somewhat stronger than those on each side of it; eighth scarcely half so long as the seventh, scarcely more slender, somewhat shorter than the ninth; tenth equal to the ninth; eleventh acuminate. The thorax is pitchy-brown, moderately convex, transverse, of the breadth of the elytra, once and a half as broad as long, emarginate in front, cut almost straight behind, where it is broadest; the sides are broadly rounded; the anterior angles depressed and rounded, the posterior projecting behind and somewhat acute. Scutellum tolerably large, finely punctate and reticulate. Elytra brown, oblong oval, nearly twice as long as broad, finely punctate and reticulate, and marked on each side of the suture with a sufficiently distinct stria, and with several others on the disk much less perceptible, particularly in front. Legs ferruginous.

This species at first sight looks very like an overgrown *fusca*, Panz., but closer examination shows that it is a good species,—the proportions of the joints of the antennæ as well as other particulars being wholly different. In a specimen which I owe to the kindness of M. Kraatz, I observe that the development of the posterior angles of the thorax is considerably exaggerated in the outline I have given, which is copied from Aubé's own figure. Aubé also states it is larger than *picipes*, Fab., which had hitherto been considered the largest known *Catops*; but my specimen is scarcely so large as the smaller individuals of *picipes*, from which I should infer that it ought perhaps rather to be stated as being about the same size as *picipes*. Its entirely ferruginous colour and the projecting posterior angles of the thorax furnish a tolerably good *prima-facie* guide to the species.

It is found in Sicily, and is as yet scarce in collections.

Fig. 7.



9. *C. picipes*, Fab.

Hydrophilus picipes, Fab. Syst. El. i. 251. 10.

Piomaphagus picipes, Illig. Käf. Pr. 893.

Catops striatus, Duft. Fn. Aust. iii. 74. 3.

— *blapsoides*, Germ. Ins. Sp. Nov. 84. 142?

— *picipes*, Erichs. Käf. d. M. Br. i. 236. 5; Sturm, Deutschl. Faun. xiv. 17. 7. t. 274. f. c. C; Heer, Fn. Helv. i. 378. 5; Redt. Fn. Aust. 144. 10; Kraatz, Stett. Ent. Zeit. xiii. 428. 9; Fairm. & Laboulb. Fn. Ent. Franç. i. 300. 4.

Ovatus, convexus, niger; antennis subfiliformibus pedibusque piceis, apice testaceis; thorace transverso, basi sublatiore, angulis posticis obtusis; elytris apice profunde striatis.

Long. $2\frac{1}{2}$ lin.

This is the largest species of the genus, with the exception of the last. Oval, *convex*, black. Antennæ scarcely thickened at the end, reddish brown at the base, blackish at the extremity, excepting the last joint, which is light yellow. Head very densely and finely punctate, mouth reddish. The *thorax* is likewise very densely and finely punctate, with a fine silky pubescence, black, strongly rounded on the sides, *narrowed both in front and behind, but most in front*, posterior angles obtuse, posterior margin very slightly sinuated on each side, *the greatest breadth behind the middle*. Elytra oval, very convex, black, with a slight grey hoar-frost bloom upon them, very densely punctate, with striæ faint in front, deeper behind. Under side black, abdomen and legs brown, tibiæ ferruginous brown, tarsi pale ferruginous.

The only species with which there is any risk of this being confounded is *C. nigricans*, Spence. Its large size removes it from all but it and *C. meridionalis*, Aubé, and *C. chrysomelooides*, Spence. Independent of other distinctions, its colour at once distinguishes it from *meridionalis*, which is ferruginous, while this is black. It likewise wants the projecting posterior angles of the thorax. Its subfiliform antennæ distinguish it from *C. chrysomelooides*, which has the heaviest and thickest clubbed antennæ in the genus; and there only remains *C. nigricans*, to which it is much more allied. Both have subfiliform antennæ, pale at the base and apex, and the proportionate length of the joints of the antennæ is much the same; they are both black, with ferruginous legs; and I have specimens of *nigricans* very little inferior in size to *picipes*, but *picipes* is a broader and more robust-looking insect. It has the elytra much more convex and bellied out, and its thorax is differently shaped, being more contracted

Fig. 8.



in front; and very commonly *nigricans* has two or three depressions on the disk of the thorax, which *picipes* has not. The posterior angles of the thorax in *nigricans* have a slight tendency to project behind, which is not the case in *picipes*.

This species is found over the greater part of Europe, but is rare. I have not yet seen a British specimen. Kraatz observes that it is principally found in fungi. Fairmaire and Laboulbène say it is taken in the trunks of trees (I presume decayed).

10. *C. nigricans*, Spence.

Choleva nigricans, Spence, Linn. Trans. xi. 141. 3.

Catops nigricans, Erichs. Käf. d. M. Br. i. 237. 6; Sturm, Deutschl. Fn. xiv. 18. 8. t. 273. f. c. C; Heer, Fn. Helv. i. 380. 6; Redt. Fn. Aust. 144. 11; Kraatz, Stett. Ent. Zeit. xiii. 429. 11; Fairm. & Laboulb. Fn. Ent. Fr. i. 303. 16.

Catops var. *minor*, *C. fuliginosus*, Erichs. Käf. d. M. Br. i. 239. 10; Sturm, Deutschl. Fn. xiv. 28. 13; Redt. Fn. Aust. 771.

C. caliginosus (Mus. Berol.).

Catops var. *major*, *C. longipennis*, Chaud. Bull. de Mosc. 1845, No. 111. 196.

Oblongo-ovatus, niger seu piceo-brunneus; antennis longioribus, obsolete clavatis, ferrugineis, apice plerumque fuscescentibus; thorace transverso, postice latiore, angulis posticis acuminatis; elytris apice substriatis.

Long. $1\frac{3}{4}$ lin.-2 lin.

Fig. 9.



Oblong-oval, convex. Black or piceous brown. Antennæ a little longer than the head and thorax, *very slightly thickened towards the extremity*, sometimes entirely ferruginous, more generally ferruginous at the base and becoming fuscescent towards the point. Head finely punctate, mouth reddish brown. Thorax very densely and finely punctate, finely pubescent, *a little narrower than the elytra*, sides rounded, *the greatest width at the middle*; very generally with two or three depressions on the disk; *posterior angles* with a point, *projecting a little behind*, which makes the posterior margin appear to be visibly sinuate on both sides. Elytra blackish brown, sometimes paler, *elongate-oval*, somewhat convex, densely and finely punctate; faintly striate, the striæ perceptible towards the extremity, effaced in front. Under side black; legs reddish brown, thighs blackish.

Kraatz gives the following remarks on the larger and smaller varieties which have been described under the names of *C. longipennis*, Chaud., and *C. fuliginosus*, Erichs.; viz.—

“A. Larger, for the most part female specimens, differ from the smaller males in many particulars, so that one may easily be

led to suppose them distinct species. In the first place, the antennæ of these larger examples are somewhat more elongate than those of the smaller specimens, and when they belong to females are also somewhat less stout, which makes them when taken as a whole look much longer than the antennæ of the smaller individuals. Then the elytra are more bellied out, so that the whole animal assumes a more convex appearance ; at the same time also the striæ of the elytra are more feebly marked in this than in the other kind. Such examples are generally found along with the rest, but not frequently, and are not of the typical form. If there had not been laid before me by himself one of the original typical examples from Germar's fine collection, it would not have been possible for me, from the short and imperfect description which Chaudoir gives of his *C. longipennis**, to perceive in it the just-described variety of *C. nigricans*, Spence."

The description by M. Chaudoir to which M. Kraatz refers is as follows, viz. :—

"Near the *umbrinus*, a little larger, form more elongate : thorax broader, more rounded on the sides : elytra less swollen out, flatter, longer : antennæ more slender, last joint of these smaller and more pointed.

"A male, found at Kiew in the garden of the town under dry leaves, in the beginning of September†."

As to Erichson's *fuliginosus*, M. Kraatz goes on—

"B. The type of *C. nigricans*, sp., is the one described as *C. fuliginosus* by Erichson, according to two specimens left by Dr. Meuer to the Royal Museum (of Berlin). Those specimens which are in the Royal Museum as *C. nigricans* are not fully coloured, and, when we have only a few specimens for comparison, such have altogether a different appearance from the full-coloured specimens. If we compare more minutely Erichson's clear descriptions of both species, we find, besides an agreement on the most important points, only two differences. One is that the antennæ of *C. fuliginosus* are darker, which proceeds from the perfectly full colouring of the animal. The other again is that the sinuation of the hind margins of the thorax (which particularly characterizes this species) is in *C. nigricans* distinct, in *C. fuliginosus* feeble,—a mark, which in individual cases is not always present in equal force, and which also appears to the eye of the observer in different aspects stronger or weaker than is really the case. There are no specimens named *C. fuliginosus*, Erichs., in the Royal Museum, but instead of it are *C. caliginosus*, Erichs., evidently projected from the description of *C. fuligi-*

* Kraatz in *loc. cit.*

† Chaudoir in *loc. cit.*

nosus. We must suppose that Erichson had originally given his specimens of *C. fuliginosus* the name of *C. caliginosus*, and as such also determined them to his acquaintances, but subsequently allowed it to remain for reasons unknown to me*."

In dealing with a description emanating from Erichson, it will probably be better that I quote his description of *C. fuliginosus*, leaving the reader to form for himself his opinion of its value as a species. It is in these terms:—

" Oblongo-ovatus, niger; antennis obsolete clavatis, rufo-piceis, apice nigricantibus; thorace basi apiceque latitudine aequali, angulis posticis acuminatis; elytris obsolete striatis.
" Long. $1\frac{2}{3}$ lin.

" Very closely allied to the foregoing (*nigrita*, Erichs.). The antennæ have the same form and the same proportions, but are differently coloured; they are brownish red, the last four or five joints including the terminal blackish. The thorax is somewhat shorter than in the foregoing, a little narrower than the elytra, lightly rounded on the sides; the posterior angles pointed; the posterior margin on each side between the edge and the middle twice feebly sinuated. The elytra are oblong oval, very indistinctly striated. The colour of the body is black; the head and thorax have a fine yellow-grey pubescence; the elytra are more brownish black, with a grey hoar-frost rime on them. The legs are ferruginous brown, the thighs blackish†."

The impression the description rather leaves upon my mind is, that Erichson's intended *fuliginosus* may have been the species subsequently described by Kellner under the name of *coracinus*. The yellow pubescence on the thorax for instance, and the ash-grey rime on the elytra, apply well to it, but not to *nigricans*: on the other hand, the size, $1\frac{2}{3}$ lin., is too much for *coracinus*. Again, it may be that the small examples of *nigricans* standing under the name of *caliginosus* in the Berlin Museum collection, were not published by Erichson from a doubt of their being distinct, and that *C. fuliginosus* may have been described from other specimens, although they are not now in the collection in the Berlin Museum.

Still, in the face of M. Kraatz's deliberate opinion, fortified as it is by the specimens in the collection of the Berlin Royal Museum, and also doubtless by the traditions which must remain of Erichson's own views in a place which has only so recently been deprived of him, I have not ventured to carry my

* Kraatz in *loc. cit.*

† Erichson in *loc. cit.*

difference of opinion further than to submit the above suggestions for the consideration of the reader.

I have only to add with reference to this species (*C. nigricans*, Sp.), that the readiest distinction between it and such others (except *C. picipes*) as are likely to be mistaken for it, is furnished by the longish almost subfiliform ferruginous antennæ. In my observations on *C. picipes* I have already noticed the *prima-facie* differences existing between it and this species.

Widely distributed, being found in Scotland and England, France, Germany, and most of Europe, but nowhere common.

11. *C. coracinus*, Kellner.

Catops coracinus, Kelln. Stett. Ent. Zeit. vii. 177. 3; Redt. Fn. Aust. 771; Kraatz, Stett. Ent. Zeit. xiii. 431. 12.

Ovatus, niger; antennis obsolete clavatis, *rufo-piceis*; thorace transverso, basi latiore, *angulis posticis distincte rectis*; elytris obsoletissime striatis. Long. $1\frac{1}{2}$ lin.

This has a considerable resemblance to *C. nigricans*, Spence, in the form of the elytra and antennæ, but is smaller, and more continuous in its outline: the hinder angles of the thorax are very slightly acuminate, so slightly as to be scarcely observable except by minute examination: the elytra are indistinctly striated. The antennæ are as long as the head and thorax, slightly thickened towards the point, in some individuals a little thicker than in others, reddish brown; the club usually blackish, but the depth of colour varies. The head and thorax are black, densely and finely punctate, *with a fine short yellowish pubescence*. The thorax is almost as broad as the elytra, broadest in the middle, straight at the base, the anterior angles rounded, *and the posterior angles right-angled at the very angle*; that is, when looked at superficially the angle would appear obtuse, but when examined more carefully there appears a very short space of right angle before the thorax takes its curved outline: the scutellum is proportionally large, and clothed with the same coloured pubescence as the thorax. The elytra are oval, densely and finely punctate, black, clothed with an ashen-grey pubescence or bloom indistinctly striated: *no yellow pubescence along the base of the elytra*. The legs are reddish brown.

Its small size, shorter and more thickened antennæ, more uniform and less bellied outline distinguish this species from *picipes*, Fab. Its shorter and more thickened antennæ, the yellow pubescence on the thorax and scutellum, want of depres-

Fig. 10.



sions on the disk of the thorax, and the want of the produced posterior angles of the thorax distinguish it from the smaller specimens of *nigricans*, Spence. Its antennæ only slightly thickened, as well as its smaller size, distinguish it from *chrysomeloides*, Spence. From most of those which have a decided yellow pubescence on the thorax it is distinguished by the want of yellow pubescence along the base of the elytra. This separates it from *tristis*, Panz., including *abdominalis*, Rosenh., *montivagus*, Heer, *longulus*, Kelln., *grandicollis*, Erichs., and *rotundicollis*, Kelln., and from *neglectus*, Kraatz, and *nigrita*, Erichs. Its yellow pubescence also is finer, shorter and more delicate than in any of these. The only remaining species with which it may be confounded is *morio*, Erichs., but the more elongate shape and slenderer form of *morio* and the difference in the posterior angles of the thorax distinguish it. *Morio* has not got the slight acumination which *coracinus* has at these angles, and in it they are gently obtuse instead of being at first right-angled. The thorax in *morio* is also flatter.

It is found in Scotland and England, and in various parts of the Continent.

12. *C. morio*, Fab.

Catops morio, Fab. Syst. El. ii. 564. 4.

Choleva dissimulator, Spence, Linn. Trans. xi. 150. 11.

Catops sericeus, Gyll. Ins. Suec. iv. 313. 1-2.

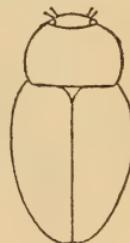
— *morio*, Erichs. Käf. d. M. Br. i. 240. 11; Sturm, Deutschl. Fn. xiv. 29. 14. t. 276. fig. b. B; Heer, Faun. Helv. 382. 14; Redt. Faun. Aust. 144. 13; Kraatz, Stett. Ent. Zeit. xiii. 431. 13; Fairm. & Laboulb. Fn. Ent. Franç. i. 301. 8.

Oblongo-ovalis, niger; antennis obsolete clavatis, articulis duobus primis ultimoque et pedibus ferrugineis; thorace basi apiceque latitudine subæquali, angulis posticis obtusis; elytris obsoletissime striatis.

Long. $1\frac{3}{4}$ lin.

The antennæ are as long as the head and thorax, imperceptibly but not greatly thickened towards the point; the first two joints are ferruginous yellow, the rest, with the exception of the last, blackish, the last joint yellow: rarely the whole antennæ are ferruginous, which Erichson observes is the case with the examples in Fabricius's collection. The body is black; the head densely and distinctly punctate; the parts of the mouth red. The thorax is rather depressed and is thickly and finely punctured, with a fine yellowish-grey dense pubescence; it is half as broad again as long; lightly rounded on the sides,

Fig. 11.



somewhat narrowed in front, but behind only a very little narrower than in the middle; the posterior angles are nearly obtuse-angled; the posterior margin is truncate and straight. The scutellum has the same pubescence as the thorax. The elytra have an ashy-grey bloom, no yellow pubescence along their base, are densely punctate, nearly without traces of striæ, a little widened in the middle, behind obtusely acuminate. The legs are ferruginous red, the thighs brown.

The same characters which distinguish *coracinus* from the other species in this group apply also to *morio*, and under that species I have already given a comparison of the differences between them. They are however closely allied.

This appears to be a rare species. So far as I know, it has not yet been taken in Scotland. It is found in England, and is widely spread over the Continent. It is included by Gebler in his list of insects found in South-west Siberia. M. Kraatz says it is found under leaves and in the chinks of wood.

13. *C. nigrita*, Erichs.

Catops tristis, Gyll. Ins. Suec. iv. 311. 1.

— *morio*, Payk. Fn. Suec. i. 344. 2.

— *nigrita*, Erichs. Käf. d. M. Br. i. 239. 9.

— *tristis*, Sturm *, Deutschl. Faun. xiv. 24. 11. t. 275. fig. c. C.

— *nigrita*, Heer, Fn. Helv. 381. 12; Redt. Fn. Aust. 144. 13; Kraatz, Stett. Ent. Zeit. xiii. 432; Fairm. & Laboulb. Fn. Ent. Franç. i. 301.

Oblongo-ovatus, niger; antennæ obsolete clavatis
rufo-piceis, clava nigra, apice testacea; thorace
basi apiceque latitudine æquali, angulis posticis
fere rectis leviter acuminatis; elytris obsoletis-
sime striatis.

Long. $1\frac{2}{3}$ lin.

Oblong-oval. The antennæ are as long as the head and thorax, imperceptibly thickened towards the point. The first six joints are reddish brown, the remainder brown, the 8th joint not much smaller than the rest, the last joint oval, acuminate, yellow. The thorax is scarcely a half broader than long, rounded on the sides, broadest in the middle; nevertheless only a little narrowed in front and behind, in front rather narrower than

Fig. 12.



* Both from his figures and descriptions it appears to me evident that Sturm has transposed the names of *nigrita*, Erichs., and *tristis*, Panz. This has not been noticed by Kraatz or subsequent authors, but a very short perusal will I think convince them of it. For instance, of *tristis*, Panz., he says, "the thorax broad, short," &c., and of *nigrita*, Erichs., "the thorax narrower than the elytra, transverse," which is just reversing the characters of the thorax; and his figures speak for themselves.

behind; the posterior angles sometimes a little pointed*, the posterior margin straightly truncate, and only towards the middle very slightly sinuated. It is covered with a yellow silken pubescence. The elytra, as well as the whole body, are black; they have a brownish-blue or purplish peachy bloom, with a yellowish pubescence more conspicuous at their base and basal margins than on the disk. They are finely punctured, very imperceptibly striated, longish oval, in the middle a little widened, behind obtusely acuminate. The legs are ferruginous red, the posterior thighs sometimes brownish.

This is the first of a little group of species, which, with a decided yellow pubescence on the thorax, has a brownish-blue or purplish bloom on the elytra, accompanied with yellow hairs or pubescence conspicuous along the base and basal margins of the elytra,—a character which will limit our comparison to only two or three species. The two species just described, *C. coracinus* and *C. morio*, have also yellow pubescence on the thorax, but their elytra have not a purplish bloom, but a greyish-ash bloom, and want the yellow hairs along the base. The yellow pubescence on the thorax of these two also is feeble both in colour and consistence compared with those which follow. The form of the thorax of this species distinguishes it from all the others. Figure 13 shows the relative form of the thorax of *nigrita* and *tristis*, the plain line being the outline of *nigrita*, and the dotted line that of *tristis*. These two species are in other respects extremely alike. The antennæ however also furnish characters of discrimination—the club of *tristis* being short, heavy and thick, while the antennæ of *nigrita* are long and thin and only obsoletely clubbed. The great breadth of the thorax of *grandicollis*, Erichs., easily distinguishes it; and the form of the thorax of *rotundicollis*, Kelln., which is an exaggerated form of that of *tristis* as above delineated (fig. 13), will prevent *nigrita* being confounded with that species or variety. The elytra in both *nigrita* and *tristis* are elongate, and give them a longer character than *rotundicollis*, which has the elytra short and rapidly acuminate.

Fig. 13.



* Erichson in his description states that the posterior angles are pointed, but Kraatz says that he cannot agree with him in that respect:—"according to my view," he says, "they are right-angled, in not a few examples passing into obtuse-angled." I have examined a considerable series carefully with a view to determine this point, and find that both are right. I possess specimens which have the posterior angles pointed, and others where there is no appearance of a point, but the line of the base of the thorax perfectly straight. This is another proof of the variable character of the genus. It also shows us how inadequate are Spence's sectional divisions which are founded on this very character.

This species is widely spread, and is found under leaves, and under the carcases of birds and small mammals.

14. *C. tristis*, Panz.

Helops tristis, Panz. Fn. Germ. 8. 1.

*Choleva Leachii**, Spence, Linn. Trans. xi.

Catops tristis, var., Gyll. Ins. Suec. iv. 312. 1.

— *tristis*, Erichs. Käf. d. M. Br. i. 238. 8.

— *nigrita*, Sturm, Deutschl. Faun. xiv. 24. 11. t. 275. f. c. C.

— *tristis*, Heer, Fn. Hely. i. 380. 8; Redt. Fn. Aust. 144. 12; Kraatz, Stett. Ent. Zeit. xiii. 433. 18; Fairm. & Laboulb. Fn. Ent. Fr. i. 302.

Oblongo-ovatus, niger; *antennis abrupte clavatis*,
clava fusca, articulo ultimo breviori; thorace
 transverso basi apiceque latitudine subæquali,
 angulis posticis rectis; elytris obsoletissime
 striatis.

Long. $1\frac{3}{4}$ lin.

Of the same size and general form as the last species (*nigrita*, Erichs.); the thorax, however, is not so broad, particularly behind. Perhaps the commonest impression it makes on a first introduction is that of an insect with longish elytra and a disproportionately short, narrow, somewhat square thorax. The antennæ are nearly as long as the head and thorax, strongly thickened towards the point; the first six joints slender, reddish brown, those following brown, broader than long, the eighth not only much shorter but also narrower than the remainder of the club, the last a little larger than the preceding, with a cone-shaped point, generally pale at the tip†. The head and thorax are black, densely punctate, more or less wrinkled transversely, and thickly covered with a close yellow pubescence; the hairs springing from the wrinkled punctuation as shown in the magnified sketch represented in fig. 15.

The thorax one-half broader than long, rounded on the sides, broadest in the middle, or perhaps rather a little before the middle, giving the *prima facie* effect of being narrowest behind; but on comparing the narrowness both in front and behind it is found nearly equal, or rather narrower before than behind. The posterior angles are sharply

Fig. 14.

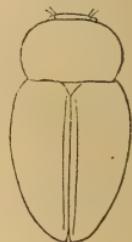


Fig. 15.



* As already mentioned, I have been unable to make out satisfactorily what the *tristis* of Spence is, and therefore have not added that as a synonym here.

† Erichson says that the last joint is brown like the preceding, but this is only the case sometimes; generally speaking it is paler.

right-angled, the straight edge proceeding a little forward before the outward curve commences: the posterior margin is almost straight, only a little sinuate towards the middle. The elytra are covered with a brownish-blue or purplish bloom, and with some yellow pubescence most observable at the base and along the basal margins*. Under the bloom the elytra themselves are brownish, lightest at the base; they are densely punctate, with feeble traces of striæ, in the middle somewhat expanded, behind oval-acuminate. Under side and thighs dark brown, tibiæ ferruginous brown, tarsi ferruginous yellow.

Erichson adds that in the males the extreme termination of each elytron is produced into a single point. In the females the point is commonly rounded. My experience is that it varies indifferently.

Fig. 16.



This is a variable species, and under it, I think, should be comprehended not only the *C. abdominalis* of Rosenhauer, the *longulus* of Kellner, and the *montivagus* of Heer, but also the *grandicollis* of Erichson, and probably the *rotundicollis* of Kellner. These I shall include as varieties under this species, giving however a separate description of each, and where I have not seen the variety in nature, quoting the words of the author who described it.

Var. A. *C. abdominalis*, Rosenh. Beitr. Ins. Fn. Eur. i. p. 22.

“ Oblongo-ovatus, niger; antennarum basi, abdominisque segmentis 2 primis ferrugineis; prothorace basi apiceque latitudine aequali, angulis posticis rectis; elytris obsoletissime striatis, antennis abrupte clavatis.

“ Long. $1\frac{3}{4}$ lin., lat. 1 lin.

“ Very similar to the *C. nigricans*, but smaller and not so convex; particularly like the *C. montivagus*, Heer, Fn. Helv. i. 381. I should consider it perhaps to belong to the latter, were it not that the posterior part of the abdomen of two examples which I possess from different districts of the Tyrol is uniformly of a different colour from that of the rest, a character which is not known to me in any other *Catops*, and which Heer must certainly have observed in describing his species had it existed in it. In the new species also the colour of the base of the an-

* It is perhaps scarcely necessary to say, that in speaking of the bloom and the pubescence on these species, I am speaking of perfectly fresh specimens in good condition. When the insect gets greasy and dirty the bloom no longer exists, and the yellow hairs get clogged together so that they look black. The best way in such cases is to turn them about in different directions, till the eye catches the light in which the pubescence or bloom best shows itself.

tennæ and of the feet is much darker and the thorax is broader. The head is not large; black, finely and densely punctate, with a yellowish-grey pubescence. The mouth is brownish. The antennæ are somewhat longer than the head and thorax, the first six joints brownish red, slender, the remainder black, broader than long, and thickened into a club towards the outer side; the eighth joint much shorter and more slender than the rest, the last somewhat more slender and about a half longer than the preceding, with an obtuse point. The thorax is densely wrinkled-punctate, and thickly clothed with close-lying yellowish hairs, transverse, about a half broader than long, rounded on the sides, broadest in the middle, narrower in front than behind, the anterior angles obtuse, the posterior straight, the posterior margin scarcely sinuated. The elytra are a little broader than the thorax, somewhat bellied out in the middle, oblong oval, usually attenuated to a point at the apex, densely and finely punctate and transversely wrinkled, covered with a grey pubescence and bluish hoar-frost, the sutural striæ very distinct, and in the middle of the elytra we perceive the trace of several striæ. Under side black, the thighs dark brown, the tibiæ ferruginous brown, the tarsi ferruginous yellow; the first two segments of the abdomen are of a lively ferruginous red, the remainder black, finely and densely punctate, delicately pubescent.

"Found in the Tyrol near Steinach and on the Franzenhöhe, 4000–8000 feet above the level of the sea*."

The reader will see that the above is a pretty accurate description of *C. tristis*, with the exception of the colour of the first two segments of the abdomen. Colour is at all times a character of very doubtful value in Coleoptera, and the constant symptom of immaturity or of not fully developed colour is the substitution for black of a ferruginous brown or red of greater or less intensity, or over a greater or less extent.

I have not seen specimens of this variety in nature, but M. Kraatz, who had authentic specimens through his hands, states that it is a mere variety of *tristis*.

Var. B. *C. longulus*, Kellner.

Catops longulus, Kellner, Stett. Ent. Zeit. vii. 176; Redt. Fn. Aust. 771; Kraatz, Stett. Ent. Zeit. xiii. 433. 17.

Oblongus, niger; antennis obsolete clavatis, basi apiceque testaceis; thorace basi apiceque latitudine æquali, angulis posticis rectis; elytris obsoletissime striatis.

Long. $2\frac{1}{4}$ lin.

* Rosenhauer in *loc. cit.*

According to M. Kellner's description this species is distinguished by its long and slender form, and thereby easily separated from the remaining varieties or species in this division.

The antennæ are of the length of the head and thorax, moderately strong, black in the middle, the basal joints reddish, the terminal joint yellowish, the club a little thickened; the head and thorax are densely punctate, clothed with yellowish-grey hairs; the latter is gently rounded on the sides, narrowed in front and behind; the posterior margin is cut straight, and only slightly sinuated on each side of the scutellum. The elytra are long and uniform in their shape, densely and finely punctate, indistinctly striated, lightly covered with yellowish-grey hairs and hoarfrosted. The legs are black-brown, the feet brownish red.

M. Kellner states that he found this kind on high hills near the mountains (of Thuringia) "under moss and on exposed dead birds: very rare."

The only discrepancy which the above description shows between this variety and *tristis* is that the club is but little thickened, and that the elytra are long and uniform in their shape. The degree of thickness of the club of the antennæ varies in all the thick-clubbed species (of course within certain bounds); and the circumstance of its being found under dead birds sufficiently shows that this is one of the thick-clubbed species. Moreover, owing to the kindness of M. Kraatz, I have seen authentic examples of it, and am thus enabled to say that the antennæ are not of less thickness than they are in many other specimens of *C. tristis*. The length of the elytra, which is in point of fact the characteristic mark of this variety, is of no value as a character, scarcely any two examples of *tristis* having the elytra of the same proportions. In some they are more bellied out than in others, which makes them look not so long, and others are longer in point of fact, but they all have the same character which cannot well be mistaken, and this supposed species is only a variety with disproportionately elongate elytra.

I have found this variety in Scotland and England.

Var. *C. montivagus*, Heer, Faun. Col. Helv. i. 381.

" Oblongo-ovatus, niger; antennis basi, tibiis tarsisque rufo-testaceis, pronoto subtransverso, basi apiceque latitudine subæquali, angulis posticis rectis, acutis; elytris obsoletissime striatis; antennis abrupte clavatis, articulo ultimo penultimo vix longiore.

" Long. $1\frac{3}{4}$ lin.

" Very similar to *C. tristis*; chiefly to be distinguished by its

thorax being a little longer, but narrower. The first five joints of the antennæ are rufo-testaceous, the eighth the smallest, much shorter and narrower than those that follow, the last shortly ovate, scarcely longer than the preceding; the thorax much narrower than the elytra, a little broader than long, with the sides lightly rounded, behind subsinuate, very densely punctulated, clothed with a dense yellow silky pubescence; elytra oblong ovate, very closely punctate, but evidently impressed with a sutural stria; thighs pitchy black.

"Very rare in the Alps. (At the Gemmi near the Dau-bensee*.)"

The above description can I think be referred to nothing but *tristis*; the greater relative length of the thorax, which M. Heer specifies as the chief distinction, being doubtless either the result of variation in the length of the elytra, or one of the variations to which this species is subject. The next variety, which I refer to the same species, shows a much greater variation in the relative dimensions and proportions of the thorax.

Neither M. Kraatz nor myself have seen authentic examples of the above species, but M. Rosenhauer speaks of it (*supra*) as if he was familiar with it, and says that but for the colour of the last segments of the abdomen in his *abdominalis*, he would have referred that species to *montivagus*. M. Kraatz having ascertained *aliunde* that *abdominalis* was an immature specimen of *tristis*, differing only in the colour of these segments, it follows that *montivagus* is what the description would lead us to suppose, viz. a variety or synonym of *tristis*.

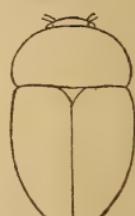
Var. D. *C. grandicollis*, Erichs.

C. grandicollis, Erichs. Käf. d. M. Br. i. 237; Heer, Fn. Col. Helv. i. 380; Redt. Fn. Aust. 144; Kraatz, Stett. Ent. Zeit. xiii. 432. 15; Fairm. & Laboulb. Fn. Ent. Franc. i. 300.

Ovatus, nigro-fuscus; antennis obsolete clavatis pedibusque rufis, illis apice nigricantibus; thorace transverso, coleopteris latiore, angulis posticis obtusis; elytris obsoletissime striatis. Long. 1 $\frac{3}{4}$ lin.

Somewhat of the form of the *C. nigrita*, but larger, and especially broader. Black-brown. The antennæ are not quite so long as the head and thorax, gradually slightly thickened, towards the point reddish brown, the last joint blackish. The head and thorax are densely punctured and granulated exactly

Fig. 17.



* Heer in *loc. cit.*

as in *C. tristis*, clothed with close-lying yellow hairs. The latter is considerably broader than the elytra, more than one-half broader than long, strongly rounded on the sides, the anterior angles rounded, the posterior angles obtuse-angled, the posterior margin cut straight, of the breadth of the elytra. These are oblong oval, somewhat convex, densely and finely punctate, indistinctly striated, brownish blue or purplish hoar-frosted, with a yellowish pubescence along the base and basal margins. The legs are brownish red.

This variety stands in a very different position from those which have gone before. They are so near the type, that they might without much harm have been described as synonyms. The present, on the contrary, differs in some respects widely from the type, and it is by no means surprising that it has hitherto been considered one of the best characterized and most distinct species.

The great breadth of the thorax is the prominent distinguishing character; its shape also is somewhat different, being nearer that of *C. nigrita*, Erichs. The grounds on which I have deemed it a variety of *tristis*, are first, that all the specimens of *grandicollis* I have taken have been in company with *tristis*, and they were generally without the admixture of another species except *rotundicollis*, which, as I have already said, I suspect to be another variety of *tristis*. The examples of *grandicollis* were almost invariably males*, and those of *tristis* for the most part females. In my earliest captures it so happened that I found nothing but males of *grandicollis* and females of *tristis*, and naturally came to the conclusion that they were the two sexes of the same thing. Subsequent researches have convinced me to the contrary, as I have now a good many male specimens of *tristis*, and one female of *grandicollis*. Still the great preponderance is as I have stated, and the result to which I have come is, that *grandicollis* is the normal form of the male, and *tristis* of the female; although, as is known sometimes to take place in other orders of animals, the female occasionally assumes the form of the male, or *vice versa*. Another ground for concluding them to be the same species is their great general resemblance to each other, notwithstanding that the one has got such a broad thorax, while in the other it is narrow. This similarity is owing perhaps to the thorax in both being transverse, and the rest of the body of the same figure. The pubescence, colouring, wrinkling and punctuation are identical, and when two fine fresh specimens with their pubescence and bloom untarnished are placed together, I think it is almost impossible to

* Erichson founded his description on a "single male specimen."

avoid the conclusion that they belong to the same species. The differences that exist other than the broad thorax are very trifling. The antennæ of *grandicollis* are perhaps a trifle thinner and not so dark in the middle as in the generality of *tristis*, and the terminal joint is usually not paler than the rest of the club. But these are all variable items in *tristis* itself. I have specimens with their antennæ in every respect to the most minute particular the same in both kinds. The only other discrepancy is, that the slight sinuation on the posterior margin of the thorax of *tristis* seems wanting in *grandicollis*. In a word, the only permanent difference is in the form of the thorax, which, in the face of the circumstances I have adverted to, does not in this instance appear to me a sufficient ground for constituting it a different species.

Another curious confirmation of this view is, that similar variations in the form of the thorax take place in *C. chrysomeloides*. In fact, I possess specimens of the latter having exactly the form of *tristis*; the sole difference being that they are larger; the thorax is more coarsely granulated, its pubescence darker; the elytra more rounded and not so acuminate at the apex, their bloom also is ash-grey instead of purplish, their base is black instead of brownish, and the yellow hairs at the base are wanting. The antennæ are thicker and darker and the last joint is longer. These particulars serve to show that it is not *tristis*; and in addition these varieties are found mixed with large numbers of the normal form of *chrysomeloides*. For instance, among about 200 specimens of *chrysomeloides* which my friend Mr. Bates recently sent me, all taken together at one time, I found three or four with the form of *tristis*; also a specimen or two having in like manner exactly the form of *grandicollis*, but with the elytra not as in the variety of *tristis* bearing that name, but as in *chrysomeloides*; the antennæ are thicker and darker, but there is no other difference in the relative proportions, except in the last joint, which is not long, as it is in *chrysomeloides*. Further, there were a few specimens in the same lot having the shorter form and more acuminate elytra of *rotundicollis*; and lastly, there were examples having the form of the thorax of *nigrita*. The result to which I have come therefore is, that similar variations in form exist both in *C. tristis* and *C. chrysomeloides*; that as we have a variety of the former with a broad thorax (*C. tristis* var. *grandicollis*), we have also a variety of the latter of like form (*C. chrysomeloides* var. *grandicollis*). In like manner of each we have *C. tristis* var. *rotundicollis* and *C. chrysomeloides* var. *rotundicollis*, and *C. tristis* var. *nigrita* and *C. chrysomeloides* var. *nigrita*. We have a var. of *chrysomeloides* like *tristis* (*C. chrysomeloides* var.

tristis), but I have not found any like resemblance to *C. chrysomeloides* in *tristis*.

In all these varieties, however, there are certain general characters which appear to be constant, and enable us to refer each variety to its proper species. These are the colour of the elytra and of its bloom, and the colour of the pubescence at the base of the elytra. There are also other characters, which, although they vary in individual species on the one side or other, are on the whole pretty constant. The antennæ of *chrysomeloides* are almost invariably considerably thicker than in *tristis*, and the last joint longer. The pubescence of the thorax (except in the same variety) is browner than in *tristis*, and, except in the var. *rotundicollis* of *tristis*, is more coarsely granulated. The form of the apex of the elytra, except in the same variety, is also rounder in *chrysomeloides* than in *tristis*.

Var. E. *C. rotundicollis*, Kellner.

C. rotundicollis, Kellner, Stett. Ent. Zeit. viii. 176. 2; Redt. Fn. Aust. 771; Kraatz, Stett. Ent. Zeit. xiii. 434. 19; Fairm. & Laboulb. Fn. Ent. Fr. i. 302.

Ovatus, nigro-fuscus; antennis obsolete clavatis; pedibus rufo-piceis; thorace transverso subrugoso, lateribus fortiter rotundatis, angulis posterioris rectis; elytris apice obsoletissime striatis. Long. $1\frac{1}{2}$ lin.

Fig. 18.



The antennæ are scarcely so long as the head and thorax, thickened towards the point, reddish brown, lighter at the base. The head and thorax are densely punctate, or rather granulated and densely covered with yellowish grizzly hairs; the latter is strongly rounded on the sides, most so towards the front, narrowed behind, the anterior angles rounded, the posterior angles almost pointed and right-angled, the posterior margin cut straight, and slightly sinuated on both sides near the scutellum. The elytra are oval, a little convex, densely and finely punctate, indistinctly striated, with a bluish or purplish bloom or hoar-frost on them, and also with yellowish hairs particularly at the base, and are narrowed to a point at the apex. The legs are brownish red, the feet lighter.

This variety or species is found along with *tristis* and *grandicollis*, but it is not without hesitation that I remove it from the list of distinct species. The characters, however, which distinguish it being all variations in degree, and at times approaching more or less to the type of *tristis*, I have come to look upon it as

a variety of that species. It is well known that carcase-feeding beetles are always more subject to variation than others, owing to the chance of the food of the larvæ becoming exhausted before they are full fed. This species may be a starved variety. The particulars however by which it is most readily distinguished are its smaller size, the strongly rounded edges of the thorax inflexed towards the base, and perhaps more than any other, the more strongly marked punctuation or rather granulation on the thorax; but none of these distinctions appear to me sufficient to justify its being kept as a distinct species. As to its size, although it is only about half the size of *grandicollis*, I have undoubted specimens of *tristis* quite as small as it; and even of *grandicollis* I have seen a specimen received by M. Kraatz from Thuringia not much larger. The general cut of the thorax is that of *tristis*, but broader in front. The elytra terminating sharply is a character also shared by *tristis*. The bluish or purplish bloom on the elytra is perhaps not quite so marked a feature as in *tristis*, but it is still well developed, and the yellow pubescence on the thorax and along the base of the elytra is the same. The distinction most appreciable is the punctuation or rather granulations on the thorax. To the naked eye, or under a weak lens, the thorax looks as if it were more coarsely punctate and of a coarser texture than in *tristis*. Under a higher magnifying power it assumes the aspect shown in fig. 19, and a comparison of that with fig. 15 and fig. 20, exhibiting the marks on the thorax of *tristis* and *neglectus* (next species), will show that it occupies a medium place between them. This punctuation in *rotundicollis* however is not always equally coarse, showing gradations to the feebler granulations of *tristis*.

Fig. 19.



It is not a rare variety, and is found under dead birds, &c. both in England and Scotland and all over the Continent.

15. *C. neglectus*, Kraatz.

Catops neglectus, Kraatz, Stett. Ent. Zeit. xiii. 434. 20.

Ovatus, nigro-fuscus; antennis obsolete clavatis pedibusque rufopiceis; thorace transverso, postice angustiore, variolariter punctato; elytris apice substriatis.

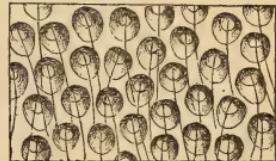
Long. $1\frac{1}{2}$ lin.

Shape entirely that of *tristis*. Antennæ obsoletely clavate, reddish brown. The head is black, deeply, densely and distinctly punctate. The thorax is in the middle almost of the breadth

of the elytra, nearly half as broad as long, somewhat convex, the sides moderately strongly rounded (exactly as in *tristis*), more narrowed behind than in front, so that the greatest breadth is before the middle. The posterior angles are right-angled, the posterior margin feebly sinuated on each side in front of the scutellum. It is covered with a dense yellow pubescence as in *tristis*, but is not granulated like it, but covered with shallow punctures, so that under a strong lens it looks exactly as if pitted with the small-pox, and out of each shallow flat pit issues a yellow hair (sometimes two, springing from the same centre); these pits are arranged in a sort of irregular transverse order (see fig. 20), which gives the thorax to the naked eye the appearance of being strongly transversely wrinkled. The elytra are densely and finely punctate, with indistinct, very evanescent traces (when highly magnified) of similar depressions being scattered over them, and with indistinct traces of striæ at the apex; they are clothed with a purplish brownish bloom similar to that of *tristis*, and with yellowish hairs principally seen at the base. The legs are brownish red, feet lighter.

Till this species was made known by M. Kraatz, it had been always overlooked. On a hasty glance it looks exactly like *tristis*; a little better inspection, particularly of the apparent granulations on the thorax, leads one to suppose it is *rotundicollis*, but a careful examination brings out the much deeper and differently formed punctuation of the thorax. This is the only character to be relied on to separate it from *tristis*; for although the antennæ are not so abruptly or heavily clavate as in that species, and are entirely of a reddish brown instead of having a blackish club, still in neither particular are they so different as to be beyond similar variations to be found in the true *tristis*. I therefore felt great difficulty in making up my mind whether they were distinct species or not. Thanks to the liberality of M. Kraatz, who supplied me with specimens of his *neglectus*, I was enabled to examine them all very carefully, which I did under high powers of the compound microscope, and although there is in one sense undoubtedly a transition between *tristis* and *neglectus* through *rotundicollis*, inasmuch as while the sculpture of the thorax in *tristis* is slightly wrinkled, that of *rotundicollis* is granulated, and that of *neglectus* variolose, still there did appear a greater difference between *neglectus* and *rotundicollis* than between the latter and *tristis*. It is not easy to embody the difference in words, but I am enabled by the kind assistance of

Fig. 20.



Dr. Greville, whose qualifications as a microscopic observer and microscopic draughtsman are unsurpassed, to submit the differences to the reader, in the woodcuts, figs. 15, 19 and 20, drawn by him, which show the sculpture of the thorax of the three kinds as seen under a magnifying power of 280 diameters. These I think prove the close relationship of *rotundicollis*, fig. 19, with *tristis* and *grandicollis* (both of which are exactly the same), fig. 15: the punctures from which the hairs issue are only a little larger and deeper in the former than in the latter, which also shows the first faint traces of the circular depressions between these punctures in the former. In *neglectus* however, although there are deep circular depressions, these are on a totally different arrangement from those in the other species. Here they surround the puncture from which the hairs spring, while in *rotundicollis* they are placed between the hairs. In *neglectus* the concave curve of the depression is turned towards the hair, in *rotundicollis* it is the convex curve which is turned to it.

Although the character is narrow, I incline to think that this is a good species, more especially as M. Kraatz mentions that nothing approaching to a transition between it and *rotundicollis* has been found.

This interesting species was taken by M. Kraatz in Hessa, but I have not yet observed it in any collection made in this country.

16. *C. quadraticollis*, Aubé.

Cutops quadraticollis, Aubé, Ann. de la Soc. Ent. de Fr. 1850, viii. 326. 35. t. 11. f. 3; Fairm. & Laboulb. Fn. Ent. Fr. i. 302.

Oblongo-ovalis, convexiusculus, niger; antennarum articulis primis et ultimo, tibiisque ferrugineis; thorace quadrato, vix postice angustiore, angulis posticis rectis.

Long. $1\frac{3}{4}$ lin.

Fig. 21.



Oblong-oval, convex. Brownish black, covered with a sparing yellowish-grey pubescence; mouth and base of the antennae obscure ferruginous. Antennae gradually clavate, a little longer than the head and thorax. Thorax almost as broad as long; sides feebly arched, almost straight, except in front, where they are pretty strongly rounded; posterior angles right-angled, a little sharply pointed; very finely and densely punctate. Elytra with a more marked punctuation, very dense; sutural stria deep, disappearing on the anterior third. With a strong lens some traces of striae are perceptible. Thighs brownish black, tibiae and tarsi obscure ferruginous.

This species is almost of the size of *tristis*, which it comes very near in form and colour. It is however a little more elongated and generally deeper in colour, and the antennæ are less clavate; but the principal difference is in the form of the thorax, which is nearly as long as broad and rectilinear on the sides, in fact nearly square; the posterior angles also are straighter. The lateral margins are a little more rounded in the males than in the females, reminding us of what we have already surmised in speaking of *tristis* and *grandicollis*, but they are always less so than in *tristis*.

At first I was disposed to consider this a variety of *tristis*, but on closer examination I became satisfied that it is a distinct species; at least, that we must hold it so until a closer study of its affinities and alliances shall teach us otherwise.

17. *C. chrysomelooides*, Panz.

Helops chrysomelooides, Panz. Fn. Ger. 57. 1.

Choleva chrysomelooides, Latr. Gen. Crust. et Ins. 29. 4; Spence, Linn. Trans. xi. 146. 7.

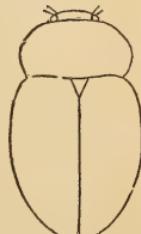
Catops chrysomelooides, Erichs. Käf. d. M. Br. i. 697. 7 a; Sturm, Deutschl. Fn. xiv. 22. 10. t. 275. f. b. B; Heer, Fn. Helv. 380. 9; Redt. Fn. Aust. 144. 10; Kraatz, Stett. Ent. Zeit. xiii. 432. 16; Fairm. & Laboulb. Fn. Ent. Fr. i. 302.

Ovatus, nigro-piceus; antennis *abrupte clavatis*, *clava nigra nitidula*, *articulo ultimo oblongo*; thorace transverso, basi latiore, *angulis posticis rectis*; elytris obsoletissime striatis.

Long. 2 lin.

Ovate, convex; deep brown or black, with a pretty dense pubescence. Antennæ shorter than head and thorax, strongly and abruptly clavate, the base (first six joints or so) red, the club black or deep brown, the fourth, fifth and sixth joints not longer than thick, also not thicker than those preceding, those following considerably thicker, the seventh, ninth and tenth somewhat thicker than long, brown; the eleventh oblong oval; the eighth narrower than the other joints of the club, very short. Thorax one-half broader than long, rounded on the sides, narrowed a little more in front than behind; at the posterior margin a little narrower than the base of the elytra; the posterior angles right-angled, pointed; the posterior margin lightly sinuated on each side, covered with a coarse yellowish grizzly pubescence. Elytra like the thorax, very finely and densely punctate, very indistinctly striated, with an ashy grey bloom; no yellow pubescence. Legs ferruginous red, often brown on the thighs.

Fig. 22.



This very distinct species is distinguished at once by the large black club of its antennæ. When seen along with other species, its gloomy black opaque appearance, combined with a larger club of the antennæ than any other species, at once point it out. The only other large black species in this group are *picipes* and *nigricans*, and neither of these has heavy thick-clubbed antennæ. From the other thick-clubbed species (none of which however have antennæ equal to it in thickness), it may be quickly distinguished by its gloomy black colour, and by the dull ash-grey bloom on the elytra. The pubescence on the thorax is dull grizzly yellow, a good deal coarser than the strong rich russet yellow of *tristis* and the other thick-clubbed species ; and the bloom on the elytra wants the purplish tinge observable in these species ; and there are no yellow hairs along the base or margins of the elytra, which are not lighter in colour themselves than the thorax. Immature specimens wholly ferruginous brown are occasionally met with. The thickness of the club of the antennæ is also not always equally great, but always greater than in any other species.

As I have already mentioned in speaking of the varieties of *tristis*, similar varieties occur of this species, viz. :—

Var. *grandicollis*, with larger broad thorax.

Var. *tristis*, with narrow short thorax and broad elytra.

Var. *rotundicollis*, of the shape of *rotundicollis*, but larger.

Var. *nigrita*, of the shape of *nigrita*.

For the differences between these varieties and the similarly named varieties of *tristis*, see the remarks on page 42.

As I have already mentioned, this species used very generally to be made to represent both *tristis* and *chrysomelooides* by British and even foreign entomologists.

It is found under small dead birds and mammals. Mr. Bates of Leicester has taken hundreds (and supplied me largely) by a simple trap which is very useful for taking some of our rarest *Clavicornes*. He puts three or four rabbits' feet into a soda-water bottle, buries it in a favourable locality, so that the mouth of the bottle is level with the ground, and in a week or ten days the interior of the bottle is swarming with insects, among which great rarities occasionally occur.

Exotic Species.

18. *C. celer*, Lucas.

Catops celer, Lucas, Explor. de l'Algérie, Anim. Art. ii. p. 225.

Oblongo-ovatus, fulvo-pubescent; capite subtilissime granario; antennis ferrugineis, ultimis articulis fuscis; thorace granario,

angulis posticis acuminatis; elytris granariis; corpore infra granario; pedibus ferrugineis femoribusque nigricantibus.
Long. $1\frac{1}{2}$ lin., lat. $\frac{3}{4}$ lin.

Very closely allied to the *C. nigrata*; black, covered with a yellow, silky, very dense pubescence. The head is very finely shagreened and scarcely pubescent. The labial as well as the maxillary palpi are of a clear ferruginous colour. The antennæ are ferruginous, with the four last joints of a deep brown. The thorax is very finely shagreened, much more pubescent than the head; it is very slightly convex, rounded on the sides, with the posterior angles projecting and pretty strongly acuminate. The scutellum is very finely granulated and scarcely pubescent. The elytra are a little more strongly granulated than the head and thorax, and are very pubescent. All the body below is granulated, scarcely pubescent, and of the same colour as above. The legs are ferruginous, very lightly pubescent, with the thighs blackish.

Found by M. Lucas in Algeria under stones in the month of June. He mentions Oran and the Bondjaréa as localities where he took it, and he observes that it is very agile.

The above description is reproduced from that of M. Lucas. I have seen specimens in his possession, but not having had an opportunity of comparing them with the specimens in my own cabinet, I am not able to pronounce positively upon them. The same remark applies to the other two species from Algeria described by him (*marginicollis* and *rufipennis*).

19. *C. fuscipes*, Menetr.

Catops fuscipes, Menetries, Mém. Acad. Imp. Sciences St. Pétersb. 6 sér. vi. (1849) p. 53.

“ Oblongo-ovatus, convexus, posterius valde angustatus pallide rufo-ferrugineus; capite, thoracis dorso, pectore abdomineque nigro-fuscis; antennis tenuibus longitudine dimidii corporis; thorace antrorsum angustato, lateribus deflexo, angulis posticis productis acutis; elytris stria tantum suturali exarata*.”

Long. $1\frac{3}{4}$ lin., lat. $\frac{3}{4}$ lin.

Menetries says that this species somewhat resembles his *C. lateritius* (already described (No. 5) in the first group), but that it is much more convex and *narrower behind, with the posterior angles of the thorax pointed and prolonged backwards*; he adds that moreover it has no perceptible striae on the elytra, except one along the suture, but that it is particularly the colour which distinguishes it at the first glance.

I have not seen this species, but the above description, particularly the portion which I have printed in italics, would seem

* Menetries in *loc. cit.*

to indicate an affinity to *C. nigricans*, and the pale colour has probably arisen from immaturity. I have therefore, in the absence of any more precise information, placed it in this group.

Menetries does not mention its locality, but as it comes immediately after *C. lateritius*, and he institutes comparisons between them, it is probable that they were found not far from each other. In that case the locality of this species would be Novaïa Alexandrovskaya.

20. *C. vestitus*, mihi.

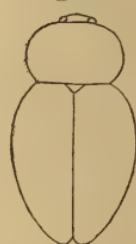
Oblongo-ovatus, fuscus, dense griseo-pubescent; antennæ clavatis, nigris, basi ferrugineis; thorace transverso, granulato, angulis posticis obtusis; elytris stria suturali.

Long. 2 lin.

Oblong-oval, blackish-brown; mouth and legs ferruginous; clothed with a thick, coarse, griseous pubescence, of a more lively fulvous colour on the thorax. The antennæ are clavate, black, except at the base, which is ferruginous; they are not so slender at the base as is usually the case, making the club look less thickened than it is in reality. The first joint is large, the second shorter and narrower; the rest are nearly all of equal length, with the exception of the seventh and ninth, which are a little longer, and the eighth, which is shorter. They gradually increase in thickness up to the seventh, which is the broadest and largest of them all; the eighth joint is smaller and thinner than the seventh and ninth, but not very minute; the terminal joint is suddenly acuminate at the tip, looking as if truncate at the end, with a short spike projecting from the centre. The thorax is transverse, broadest a little behind the middle. The posterior angles are obtuse, except at the very angle, where there is an exceedingly minute rectangular starting-point. The surface is coarsely granular. The scutellum is small. The elytra are granulated and have a distinct sutural stria, but apparently no others—at least the traces, if any, are exceedingly indistinct. The anterior tarsi and first joint of the middle tarsi are dilated in the male.

This species has some resemblance to *C. chrysomeloides*, but it is smaller, the thorax is narrower and more transverse, the antennæ are not so heavily clubbed, and the joints are differently proportioned. It has also some resemblance to *C. tristis*, but the form of the thorax as well as a difference in the pubescence distinguish it. The pubescence is coarser and more dense than in most other species.

Fig. 23.



From the East Indies (Boys' collection). The above description is taken from a unique (male) example kindly presented to me by my friend Mr. Westwood.

21. *C. Spencianus*, Kirby.

Choleva Spenciana, Kirby, Fn. Bor. Amer. p. 108 (1837).

Catops cadaverinus, (Esch.) Mannerh. Beitr. zur Käf. Faun. der Aleutischen Inseln, Sitka, und Calif., aus d. Bull. Naturforsch. Moscow, xvi. (1843) p. 82. no. 173.

— *fuscus*, Hoff. var. Dej. Cat. 3rd ed. 133.

“ Oblongo-ovatus, fusco-piceus, tenuo-pubescent; antennae mediocribus, clavatis, basi ferrugineis; thorace brevi transverso, basi parum lato, angulis posticis obtusis; elytris rufescentibus punctatis, stria suturali impressa; pedibus ferrugineis piceis; femoribus infuscatis.

“ Long. 1 $\frac{1}{2}$ lin., lat. 1 lin.*”

Body black, covered with decumbent pale hairs. Head minutely punctured; antennae shorter than the prothorax, the two first joints ferruginous, the eighth shorter and smaller than the rest; mouth and palpi ferruginous; prothorax not visibly punctured, with all the angles rounded; base with a slight sinus on each side; elytra acute, very minutely punctured, with a hair emerging from each puncture, without furrows, except a single one parallel with the suture, ferruginous, black at the tip; abdomen piceous, rufous at the base; legs ferruginous.

Found in the Sitka Islands by Eschscholtz and Kuprianoff.

A comparison of the authentic unique specimen of Kirby's *Choleva Spenciana* preserved in the British Museum, with specimens of Mannerheim's *Catops cadaverinus*, shows that they are the same species.

Mr. Kirby remarks regarding it, that “ This species appears to present the type of a new family of *Choleva*, not noticed in Mr. Spence's 'Synopsis Sectionum' in his admirable Monograph of that genus. From his first section (*Choleva*, Steph.) it borrows the rounded posterior angles of the prothorax; from his second (*Catops*, Steph.) its clavated antennae; and from his third (*Ptomaphagus*, Steph.) its unfurrowed elytra: it seems properly included in the second, with which it most agrees in habit†.”

Var. b. Mann. Bull. de la Soc. Mosc. 1843, pp. 173, 254.

Ferrugineo-testacea; capite fusco; thoracis disco antennisque infuscatis; elytris pallide livido-testaceis, postice nonnihil obscurioribus.

As Count Mannerheim observes, this species is somewhat allied to *C. morio*, Erichs. (*fuscus*, Gyll.), but distinguished from it by

* Mannerheim in *loc. cit.*

† Kirby in *loc. cit.*

Fig. 24.



the thorax being smaller and narrower and the elytra longer. The colour both of the pubescence and body is paler.

In carcases in the island of Afognak; taken sparingly in the month of August by M. Holmberg, who also took it in California. It was likewise brought by M. Frankenhäuser from the interior of the Peninsula of Kenai.

For the figure of this and the other American species I am indebted to my friend Dr. Leconte of Philadelphia, who has kindly furnished me with drawings of them made expressly for my use in this paper. They are in half outline, and all his figures are four times enlarged. The head is brought up simply to show proportions.

22. *C. brunnipennis*, Mann.

Catops brunnipennis, Mann. *Nachtrag zur Käfer-Fauna der Nord-Amerikanischen Länder der Russischen Reiches*, Mosc. 1853, p. 14.

“Oblongo-ovatus, convexus, crebre subtilissime reticulato-strigulosus, nigro-piceus, griseo-pubescent; antennis thorace vix brevioribus, ferrugineo-testaceis, clava parum incrassata fusca, articulo octavo minutissimo; thorace longitudine sesqui latoe lateribus modice rotundatis, antice latitudine basis haud angustiore, angulis omnibus subrotundatis; elytris obscure castaneis, apice subacuminatis, stria suturali leviter exarata; pedibus piceo-testaceis.”

“Long. $1\frac{3}{4}$ lin., lat. $\frac{5}{4}$ lin.

“Longer than *C. cadaverinus*, Esch., more narrowed behind, besides differing from it in having the antennæ more slender, the thorax much broader, shorter, and not narrowed in front.

“Found tolerably frequently near the river Tschunuktnu in the Peninsula of Kenai, in carcases at the end of June, M. Frankenhäuser*.”

The reader owes the figure of this species to Dr. Leconte.

23. *C. luridipennis*, Mann.

Catops luridipennis, Mann. *dritten Nachtrag zur Käfer-Fauna der Nord-Amerikanischen Länder des Russischen Reiches*, Mosc. 1853, p. 84.

“Ovatus, convexus, crebre subtilissime reticulato-strigulosus, nigro-piceus, griseo-pubescent; antennis thorace nonnihil longioribus, crassiusculis nigris, articulo octavo minuto; thorace longitudine fere duplo latoe, lateribus rotundato, antice latitudine basis haud angustiore, angulis omnibus rotundatis; elytris obscure castaneis, apice obtusis rotundatis, stria suturali leviter exarata; tarsis rufis.”

“Long. $1\frac{1}{2}$ lin., lat. $\frac{5}{4}$ lin.†”

* Mannerheim in loc. cit.

† Ibid.

Mannerheim says that this species is allied to his *C. brunni-pennis*, but is shorter, and is besides distinguished by having the antennæ thicker, the thorax shorter, its sides more rounded, and the elytra rounded at the apex.

Collected in carcases in the months of July and August by M. Frankenhäuser on the banks of the Tschunuktnu in the Peninsula of Kenai: not frequent.

24. *C. simplex*, Say? Lec.

Catops simplex, Say? Journ. Acad. Nat. Sc. Philad. v. 184; Leconte, Synopsis of the Silphales of America in Proceedings of Acad. Philad. 1853, 281.

Fig. 27.

“ *Piceus, fulvo-sericeus*, dense punctulatus; thorace antrorsum subangustato, lateribus rotundatis, basi late rotundato; elytris obsoletissime striatis, stria suturali profundiore; antennis basi testaceis; tibiis calcaribus mediocribus armatis.

“ Long. $1\frac{3}{4}$ lin.

“ The anterior tarsi and first joint of the middle tarsi of the male are moderately dilated; the antennæ are as long as the head and thorax, moderately thickened; the seventh joint is a little larger than the sixth, and equal to the ninth; the eighth is about one-half smaller*.”

The above is Dr. Leconte's description; the following is Say's:

“ Pale brownish, sericeous; terminal and five basal joints of the antennæ rufous. Inhabits Arkansas. Head dark ferruginous; antennæ dark ferruginous, the five basal joints and terminal joint rufous; palpi and mandibles ferruginous; thorax rather paler than the head, quadrate, a little transverse, sides regularly arcuated; posterior margin not wider than the anterior; posterior edge rectilinear; angles rounded; elytra paler than the thorax, light brownish, with obsolete striæ, more obvious towards the tip; very numerous minute punctures furnishing minute hairs; beneath piceous; feet rufous; thighs yellowish beneath. Length nearly $\frac{5}{20}$ ths of an inch. This species occurred on dung†.”

Dr. Leconte in speaking of his species remarks, that he is not positively certain that it is Say's species, which was found in Arkansas, while his was from New York. He adds, “ The thorax is more narrowed in front than described by him; although the legs are in reality black, the lustre of the fulvous hair is such, that one might readily be tempted to describe them as testaceous at base.”

* Leconte in *loc. cit.*

† Say in *loc. cit.*



25. *C. clavicornis*, Lec.

Catops clavicornis, Lec. Synopsis of Silphales of America in Proceed. Acad. Philad. 1853, 281.

Fig. 28.

“Oblongo-ovatus, ater, subtiliter pubescens, dense punctulatus; thorace antrorsum valde angustato, lateribus rotundatis, basi late rotundato; elytris versus apicem obsolete striatis, stria suturali profunda; antennis thorace brevioribus, magis clavatis.

“Long. $1\frac{3}{4}$ lin.



“One female: New York. This species is readily distinguished from the preceding (*C. simplex*) by the shorter, more clavate antennæ, which are only indistinctly testaceous at the base; the seventh joint is about twice as large as the sixth; the eighth is smaller than the sixth, and appears only about one-third as large as its neighbours. The spines of the tibiæ are somewhat smaller than in the preceding species (*simplex*)*.”

2nd Subdivision. *Thorax forming a continuous or nearly continuous line with the elytra; middle tarsi of the males widened in some species, in others not.*

In the last subdivision our arrangement led us gradually from the species with slender antennæ to those with the heaviest and thickest-clubbed antennæ. The affinity to these leads us now to reverse this order, and to commence this subdivision with those having similar thick antennæ.

A. *Antennæ heavily clubbed and middle tarsi widened in the males.*26. *C. fumatus*, Erichs.

Choleva Watsoni, Spence, Limn. Trans. xi. 156.

Catops agilis, Fab. Syst. Eleuth. ii. 565. 6; Gyll. Ins. Suec. i. 277. 2; Panz. Faun. Germ. 95. 10; Duft. Fn. Aust. iii. 75. 4.

Catops fumatus, Erichs. Käf. d. M. Br. i. 240. 12; Sturm, Deut. Fn. xiv. 31. 15. t. 176. f. c. C; Heer, Fn. Helv. i. 382. 15; Redt. Fn. Aust. 144. 7; Kraatz, Stett. Ent. Zeit. xiii. 436. 22; Fairm. & Laboulb. Fn. Ent. Fr. i. 303. 14.

Oblongo-ovalis, fusco-piceus; antennis brevibus, clavatis, basi apiceque ferrugineis; thorace brevi, basi latiore, angulis posticis rectis; elytris pedibusque testaceis.

Long. $1\frac{1}{2}$ lin.

One of the smaller species. Oblong oval. Deep brown. Antennæ short and thick, a little longer than the thorax, brown; last joint broader than long, both it and the three first joints ferruginous.

Head black, densely punctate. Thorax with reddish transparent

Fig. 29.



* Leconte in *loc. cit.*

margins, slightly arched ; densely and finely punctate, almost twice as broad as long, as broad at the base as the elytra, or very nearly so, narrowed in front ; posterior angles right-angled, pointed ; posterior margin almost straight. Elytra oval, acuminate, densely punctate, without traces of striæ, except the sutural ; reddish-brown, often brownish at the extremity. Under side blackish-brown. Legs ferruginous.

Distinguished from the other European species of this subdivision, except *alpinus* and *scitulus*, by its short, thick, heavily-clubbed antennæ.

The *alpinus* is clearer in colour, is longer, and has the thorax usually narrower than the elytra. *Scitulus* differs from *fumatus* in having the antennæ longer, the elytra broader, the posterior angles of the thorax projecting, and the colour somewhat different, the elytra being brown, without the reddish tint which is characteristic of *fumatus*, particularly at the base of the elytra, and having a marked sericeous lustre.

One of the commonest species. It is found in Scotland and England, and all over Europe, under detritus, in decaying fungi and under leaves.

27. *C. alpinus*, Gyll.

Catops alpinus, Gyll. Ins. iv. 3121. 2 ; Heer, Fn. Helv. i. 318. 11 ; Kraatz, Stett. Ent. Zeit. xiii. 435. 21.

Catops subfuscus, Kellner, Stett. Ent. Zeit. viii. 177. 4 ; Redt. Fn. Aust. 771 Oblongo-ovalis, fusco-piceus ; *antennis abrupte clavatis*, Fig. 30.*

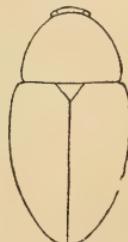
basi ferrugineis ; thorace brevi, *angulis posticis obtusiusculis* ; elytris pedibusque rufo-brunneis.

Long. $1\frac{1}{2}$ - $1\frac{3}{4}$ lin.

Very like *C. fumatus*, but usually somewhat larger, with a narrower thorax, the posterior angles of which are obtuse, and the basal margin not so broad as the elytra. The antennæ are as long as the head and thorax, with the basal joints reddish and thick ; club blackish ; the last joint is usually black, but sometimes yellowish at the tip. The head is black, densely and finely punctate, with a yellowish pubescence. The thorax is blackish-brown, densely punctate, densely clothed with yellow hairs, at the basal margin not so broad as the elytra, cut straight, and slightly sinuate on both sides of the scutellum, the anterior angles obtuse and the posterior angles slightly rounded. The elytra are oval, densely punctate, lightly clothed with yellow pubescence, clear reddish-brown, generally blackish at the tip and towards the suture. The legs are brownish-red.

The normal specimens are readily distinguished from *fumatus* by their larger size and more elongate form, and by the thorax

* The comparative breadth of the elytra is rather exaggerated in this figure.



being narrower than the elytra; but these characters are sometimes wanting, and in form the smaller specimens do not differ from *C. fumatus*; the clearer colour, the particularly strong dark club of the antennæ with its eighth joint proportionately smaller, then serve to distinguish it; but on the whole I am very doubtful of its being more than a variety of *fumatus*, and it is with hesitation I have placed it as a distinct species.

Generally distributed over the north of Europe; but I have not yet seen British specimens.

28. *C. brevicollis*, Kraatz.

Catops brevicollis, Kraatz, Stett. Ent. Zeit. xiii. 436. 23.

“Ovatus, fusco-piceus; antennis ferrugineis obsoletissime clavatis, articulo ultimo duobus præcedentibus longitudine aequali, acuminato; thorace fusco, transverso, basi latiore, angulis posticis rotundatis; elytris substriatis pedibusque rufo-testaceis.

“Long. 1½ lin.”

I have not seen this species. The following is M. Kraatz's description:—

“Nearly in the middle between *C. fumatus* and *C. scitulus*. Easily distinguished from both by the wholly different thorax and form of the antennæ. Pitchy-brown; elytra and legs brownish-yellow. The antennæ are somewhat longer than the head and thorax, reddish-brown throughout; the club scarcely perceptibly thickened; the five last joints are only a little stouter than those preceding, and are of equal breadth; the first joint is somewhat longer and a little stouter than the second; the third somewhat shorter than the second, distinctly larger than the fourth, almost equal to the sixth; fifth scarcely larger than those on each side of it; seventh half as long again and somewhat stouter than the sixth, equal to the ninth; eighth scarcely slenderer, and half as long as those on each side of it; tenth a little shorter than ninth; eleventh as long as ninth and tenth together, from the middle outwards sharply acuminate. The head is pitchy-black, very finely moderately densely punctate; the mouth brownish-yellow. The thorax of the breadth of the elytra, broadest at the base, more than twice as broad as long, tolerably strongly and symmetrically narrowed from the base towards the front. The anterior angles are rounded, somewhat depressed; the obtusely rounded hinder angles project a little beyond the anterior margin of the elytra; the posterior margin is very feebly sinuated on both sides near the middle; the upper side is moderately, densely, finely shagreen-punctate, pitchy-black; the sides and posterior margin brownish, tolerably closely covered with a long yellowish-grey pubescence. The elytra are uniform, only slightly narrowed behind, densely and finely punc-

tate, with a slight bloom or hoar-frost on them, sparingly and finely pubescent, brownish-yellow. The under side of the body is pitchy-black. The legs are reddish-yellow*."

M. Kraatz has established this species upon one example from Sicily, communicated by Zeller to the Royal Museum of Berlin.

29. *C. scitulus*, Erichs.

Choleva fumata, Spence, Linn. Trans. xl. 155. 4.

Catops scitulus, Erichs. Käf. d. M. Brand. i. 241. 13; Sturm, Deutschl. Faun. xiv. 33. 16; Redt. Faun. Aust. 772; Kraatz, Stett. Ent. Zeit. xiii. 437. 24; Fairm. & Laboulb. Fn. Ent. Fr. i. 304. 17.

Ovatus, fuscus; antennis leviter clavatis, ferrugineis; thorace postice latiore, *angulis posticis productis, rectis*; elytris pedibusque obscure fusco-testaceis.

Long. $1\frac{1}{2}$ lin.

Oval, brown. Antennæ as long as head and thorax, ferruginous, a little deeper before the extremity. Head brownish-black, densely punctate. Thorax large, deep brown, densely punctate, only one-third broader than long, as broad at the base as the elytra, narrowed in front from the middle, rounded on the sides; posterior angles pointed, a little projecting behind, which makes the posterior margin visibly sinuated on each side. Elytra oval, slightly acuminate, densely punctate, without vestiges of striæ, except the sutural; testaceous-brown, extremity blackish. Legs ferruginous.

Resembles *C. fumatus*, but differs by having the antennæ longer, the elytra broader, and the posterior angles of the thorax projecting a little behind, and its colour darker and concolorous; and covered with a fine silky pubescence, so that when looked at from behind, a paler sericeous band appears to stretch across the elytra.

Not common. Has been taken near Berlin, in Thuringia, Erlangen, Switzerland, near Paris, near London, and in the south of England. I have not seen any examples taken in Scotland.

B. *Antennæ not heavily clubbed; middle tarsi of males rarely widened.*

30. *C. depressus*, mihi.

Fig. 32.†

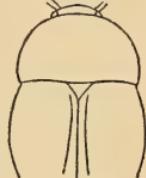
Breviter ovatus, postice attenuatus, ferrugineus; antennis subfiliformibus; thorace transverso, subdepresso, postice latiore, *lateribus postice leviter inflexis*; *angulis posticis fere acutis*; elytris palidioribus, substriatis.

Long. $1\frac{7}{8}$ lin.

Entirely of a pale ferruginous colour; the elytra

† The sinuations of the thorax and prominence of the shoulders are rather exaggerated in this figure.

* Kraatz in *loc. cit.*



paler, and the legs testaceous. The antennæ are slender, pale ferruginous; first joint stouter and longer than the second; third joint nearly twice as long as the second; fourth nearly as long as the third; fifth and sixth joints nearly equal in length—if there is any difference, the fifth is longer than the sixth, but this is scarcely perceptible; they are also all of the same breadth, and each is shorter than the third; the seventh is a little longer than the sixth, and broader; the eighth is only half as long as the seventh, but scarcely narrower; the ninth and tenth are nearly equal in length, rather broader than the seventh; the eleventh is nearly round, but with a slight obtuse point at the tip. Head brown, pretty closely and distinctly punctate, most deeply in front, and with a shallow frontal depression; clothed with a yellowish pubescence. Thorax transverse, subdepressed, narrowest in front; the posterior angles meeting, and as broad (or nearly so) as the base of the elytra, the lateral margins with a slight appearance of inflexion just before the posterior angles; the anterior angles rounded; the posterior angles somewhat acute; posterior margin broadly sinuate towards the sides; shagreen-punctured, clothed with a yellowish pubescence. Elytra $2\frac{1}{2}$ times as long as the thorax, ferruginous-red; shoulders prominent, and tapering from them towards the apex; turned rapidly in at the apex, so as to make it appear almost slightly truncate; a depression surrounds the scutellum (which is large and triangular) and extends along on each side of the suture for more than half the length of the elytra, the back of each elytron rising in a somewhat humped manner from the depression; there is a deep sutural line running up the middle of this depression; it touches the suture at the apex, expands as it goes along, and contracts almost to the suture again when it reaches the scutellum; the elytra are tolerably distinctly striated, the striae deepest at the apex; shagreen-punctured, and clothed with a close testaceous yellow pubescence. Legs and under side of same colour as upper side, but rather paler, clothed with a similar pubescence.

At first sight this species is very like *fuscus*, many specimens of which have the same depression on the back of the elytra; but it is distinguished at once by the different form of the posterior part of the thorax, which in *fuscus* turns in to meet the base of the elytra, while in this species it does not. The joints of the antennæ are also somewhat different in their proportions, and the elytra taper more rapidly to the apex, and the apex itself at its extremity has a tendency to become semi-truncate for a short space, while in *fuscus* the apex is rounded off to the suture. There is, however, no doubt that this is very much akin to *fuscus*, and, in a strictly natural arrangement, should come next to it; but no arrangement will provide for all

the aberrant forms which occur, and an occasional separation of nearly allied species must be submitted to, for the sake of the greater facility of determination afforded by artificial divisions.

The above description is taken from a single female specimen which I found in M. Chevrolat's collection, and which, although unique, he has kindly ceded to me. It stood among his European species, but the exact locality was not mentioned.

31. *C. umbrinus*, Erichs.

Catops umbrinus, Erichs. Käf. d. M. Brand. i. 235. 4; Redt. Fn. Aust. 771; Kraatz, Stett. Ent. Zeit. xiii. 407. 7; Fairm. & Laboulb. i. 303. 15.

Ovatus, brunneus; antennis subfiliformibus; thorace transverso, postice latiore, angulis posticis elongatis, acutis; elytris substriatis.

Long. $1\frac{3}{4}$ lin.

Short oval, brown. Antennæ scarcely thickened at the extremity, ferruginous, lighter at the base, clear yellow at the apex. Head almost black; mouth reddish. Thorax densely and finely punctate, broadest behind, posterior margin sinuate, and the posterior angles pointed, projecting, embracing the base of the elytra. Elytra very slightly widened in the middle, obtusely rounded at the apex, finely and densely punctate with indistinct striæ, scarcely more visible behind. Legs reddish. Middle tarsi of males widened.

The completely oval shape of this species, the outline of the thorax fitting exactly to the elytra, distinguishes it from all but a few. Its slender antennæ distinguish it from those in the preceding section of this subdivision. It is the largest species of this section, and comes nearest to *C. velox*. Its larger size, darker colour, the posterior angles of the thorax more projected behind, and the middle tarsi widened in the males, distinguish it from that species.

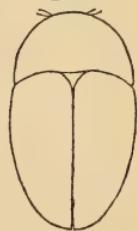
Widely distributed over the Continent, but I am not aware of its having been taken in Britain*. It has been taken near Stettin, Berlin, in Austria, near Kiew, Paris, Fontainebleau, &c., on trees and under leaves.

32. *C. velox*, Spence.

Choleva velox, Spence, Linn. Trans. xi. 154. 13.

Catops velox, Erichs. Käf. d. M. Brand. i. 241. 14; Sturm, Deutschl. Faun. xiv. 3. 5. 17. t. 277. f. b. B; Heer, Fn. Helv. i. 383. 17; Redt. Fn. Aust. 144. 15; Kraatz, Stett. Ent. Zeit. xiii. 437. 25; Fairm. & Laboulb. Fn. Ent. Fr. i. 304. 18.

Fig. 33.



* I recorded this in my 'Catalogue of Scottish Coleoptera' as having been taken by Mr. Morris Young near Paisley, but I am now satisfied that this was a mistake.

Ovatus, ferrugineus; capite fusco; antennis longioribus, obsolete clavatis, ferrugineis; thorace transverso, basi latiore, *margine postico leviter sinuato*, angulis posticis rectis; elytris obsoletissime striatis, *subtilissime transversim rugulosis*.

Oval, ferruginous-red; head brown, reddish in front, extremely finely punctate. Antennæ as long as the head and thorax, slender, very feebly thickened towards the extremity, ferruginous, the last joint not more slender than the preceding, excised at the extremity. Thorax densely and finely punctate, as broad behind as the elytra, one half broader than long, rounded on the sides, narrowed in front; posterior angles right-angled, pointed a little inwards; posterior margin lightly but visibly sinuate on each side; ferruginous, with the disk darker, and the margins semi-transparent. Elytra scarcely widened in the middle, obtusely rounded at the extremity, with very indistinct striae; surface densely punctate, finely wrinkled across. Anterior legs slightly widened at the extremity; middle tarsi not widened in the males.

Distinguished from *C. scitulus*, to which it has considerable outward resemblance, by its more slender antennæ, its paler colour, the margins of the thorax lighter-coloured than the disk, its transversely wrinkled elytra, and its middle tarsi not widened in the males.

Differs from *C. umbrinus* by its smaller size, its lighter colour, the posterior angles of the thorax not produced behind, the elytra transversely wrinkled, and the middle tarsi not widened in the males.

Found throughout Britain and over the Continent not unfrequently. It has also been taken by Chaudoir at Kiew, and by Wollaston at Madeira, where, however, it appears to be excessively rare.

33. *C. badius*, Dahl., Sturm.

Catops badius, Meg. Dahl. Col. et Lepid. 30; Sturm, Deutschl. Fn. xiv. 40. 20. t. 278. b. B; Heer, Faun. Helv. i. 383. 19; Redt. Fn. Aust. 145. 15; Kraatz, Stett. Ent. Zeit. xiii. 437. 26.

Ovatus, piceo-brunneus; antennis longioribus, obsolete clavatis, ferrugineis; thorace transverso, basi latiore, *margine postico recto, angulis posticis rectis, prominulis*; elytris obsoletissime striatis.

Long. $1-1\frac{3}{4}$ lin.

Perfectly egg-shaped, the sharper end behind, gently convex, clear pitchy-brown, the whole upper side clothed with a fine, adpressed, yellow-

Fig. 34.

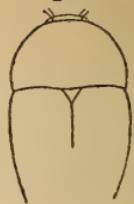
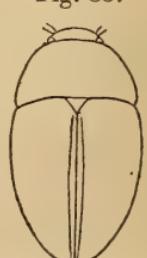


Fig. 35.



ish-grey pubescence. The antennæ are a little longer than the head and thorax, ferruginous-yellow, somewhat thickened towards the point; the seventh joint longish, the eighth shorter, but as broad as the last, the terminal joint obtuse roundish. The head is very finely punctate, the eyes black. The thorax is finely and densely punctate, short, behind exactly as broad as the base of the elytra, strongly narrowed in front, the anterior and posterior margins not sinuate, the sides lightly rounded, the posterior angles right-angled, somewhat projecting over the shoulders of the elytra. The scutellum large, triangular, finely punctate. The elytra are oblong-oval, widest in the middle, behind acuminate-oval, finely shagreened, with a deeply impressed sutural stria, but without traces of other striæ. The under side of the body and the legs are of the same colour as the upper, only somewhat lighter.

Distinguished from *C. velox* by its decidedly more slender form, by its colour always pitchy-brown and not reddish-brown, and by the posterior angles of the thorax somewhat projecting over the margins of the elytra.

Differs from *C. præcox* by its thorax not being wider than the elytra, and from *C. brunneus* by its larger size, and the posterior angles of the thorax not being obtuse.

This species seems rare. Sturm simply says it is found in Austria. Kraatz says he has only seen two specimens, which came from Vienna. I have not seen it.

34. *C. præcox*, Erichs.

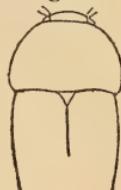
Choleva Wilkinii, Spence, Linn. Trans. xi. 157.

Catops præcox, Erichs. Käf. d. M. Br. i. 242. 15; Sturm, Deutschl. Fn. xiv. 37. 18. t. 277. f. c. C; Heer, Fn. Helv. i. 318. 18; Redt. Fn. Aust. 145. 16; Kraatz, Stett. Ent. Zeit. xiii. 438. 27; Fairm. & Laboulb. Fn. Ent. Fr. i. 304. 19.

Oblongo-ovatus, ferrugineus; antennis longioribus, obsolete clavatis, ferrugineis; thorace brevi, basi latioire, *margine postico recto, angulis posticis obtusis*; elytris obsolete striatis, *paulo angustioribus quam thorace*.

One of the smallest species, of a peculiar shape, oblong-oval, gradually narrowed behind, with the apex somewhat truncate, brownish ferruginous, clothed with a very fine and thin yellowish pubescence. The antennæ are ferruginous-red, almost longer than the head and thorax; only the three last joints are perceptibly thicker than those preceding, and the eighth joint decidedly shorter, but not more slender than the seventh. The head is frequently brownish or blackish on the front. The thorax is large, transverse, very

Fig. 36.



slightly, but still perceptibly, broader than the elytra; the sides are rounded, more narrowed in front than behind; the posterior angles obtuse; the posterior margin straight, very finely and densely punctate. The scutellum is of the form of an equilateral triangle. The elytra are oblong, straight, perceptibly narrowed behind, with the apex truncate, somewhat flat, more distinctly punctate than the thorax, and very feebly and indistinctly striated, with the exception of the sutural stria, which is deeply impressed. The anterior tibiae are slightly widened towards the extremity.

Where the characteristic breadth of the thorax is well marked, this species can be recognized by the base of the thorax being a little wider than the base of the elytra, and by the elytra narrowing backwards and becoming truncate: where this is less conspicuous, the smaller size, narrower shape, the straight margins of the elytra, and their narrowing behind, distinguish it from *C. velox*. From *C. badius*, its smaller size, much lighter colour, straight posterior margin of thorax not projecting backwards at the posterior angles, separate it; and it is distinguished from *C. brunneus* by the finer punctuation of the elytra.

Spread over all Europe, including Scotland and England, but everywhere scarce.

35. *C. transverso-striatus*, Dej. Cat.

Catops transverso-striatus, Dej. Cat. 3rd ed. p. 133.

Angustatus, *elongatus*; *antennis longioribus quam capite et thorace*; *elytris postice attenuatis, striatis et fortiter elongatis, transversim strigosis*.

Mas, *elytris longissimis. Long. $1\frac{1}{4}$ lin.*

Fœm., *elytris minus elongatis. Lat. 1 lin.*

This species bears considerable resemblance to *C. præcox*, is of the same colour, but is larger, and in the male especially has the elytra much more elongate. It has also the elytra very deeply transversely strigose, and has seven distinctly impressed irregular striæ, besides a deep sutural stria.

Male. Pubescent, of a yellowish testaceous or pale brown colour. The antennæ are testaceous, slender, longer than the head and thorax. The first and second joints are long, the first a little shorter and thicker than the second; the second, third and fourth are about equal in length; the fifth, sixth and seventh are all nearly of the same breadth and thickness, but each a little shorter than the one preceding it; the eighth is slightly shorter than those on each side of it. The last three are thick-

Fig. 36a.



ened; the last is short and a little acuminate. The head is a little darker than the rest of the body, and the mouth somewhat lighter. The thorax is pubescent, smooth, not punctate, but feebly granulose, broader than long, rounded on the sides, broadest a little behind the middle, bisinuate at the base, with the posterior angles projecting slightly backwards. The scutellum is large and acutely triangular. The elytra are very long, being five times the length of the thorax, and taper towards the apex in a wedge-shape. They are very deeply transversely wrinkled, with a profound sutural stria, and seven other striae less deeply impressed but still quite distinct. The apex of each elytron is somewhat rounded. The margins of the elytra are broadly inflexed, leaving a prominent lateral ridge.

Female. The above description will apply also to the female, with the following alterations:—She is much shorter and comparatively broader, and the elytra are not so disproportioned in their length. The antennæ are shorter and thicker, the base and apex much paler than the middle. The impressed striae on the elytra are much less evident, but the transverse strigations are equally distinct.

No species that I have seen has the transverse strigations so strongly marked. It may at first sight be mistaken for a very large *præcox*, but these strigations and the almost disproportionate length and wedge-shape of the elytra in the male distinguish it readily.

I found three males and one female under this name, marked as coming from Portugal, in the collection of the Count Dejean; the kindness of M. le Marquis de Laferté Senectère having placed that collection in my hands for examination.

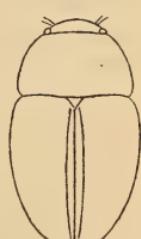
36. *C. brunneus*, Dahl., Sturm.

Catops brunneus, Knoch, Dahl. Col. et Lepid. 30; Sturm, Deutschl. Fn. xiv. 38. 19. t. 278. f. a. A; Redt. Fn. Aust. 145. 16; Kraatz, Stett. Ent. Zeit. xiii. 439. 28.

Ovatus, piceo-brunneus, *fumatus*; capite fusco; antennis longioribus, obsolete clavatis, ferrugineis; thorace transverso, basi latiore, *margine postico recto*, *angulis posticis obtusis*; elytris brunneis.
Long. 1 lin.

As large as *C. præcox*, but of a wholly different shape. It is broad-oval, moderately flat, behind broadly truncate, ferruginous-brown and shining. The antennæ are as long as the head and thorax, thin, gradually somewhat thickened towards the apex, the terminal joint roundish, pubescent, the eighth joint short. The head

Fig. 37.



broad, pitchy-black, finely punctate; the parts of the mouth ferruginous-red. The thorax is large, broad, as broad at the base as the elytra, only slightly narrowed in front; the sides lightly rounded; the posterior angles obtuse; the basal margin straight; it is moreover slightly convex, somewhat darker on the back, very finely and densely punctate, and thinly clothed with a fine yellowish-grey pubescence. The scutellum is obtusely triangular, densely punctate. The elytra are of a short and broad oval form, broadly truncate at the apex, finely shagreen-punctured, thinly clothed with a yellowish-grey pubescence, deeply impressed with a sutural stria, and without any traces of other striae. The abdomen is pitchy-black; the legs are ferruginous-yellow.

The salient points in which it differs from *C. præcox* have been already noticed. It is larger, more densely pubescent, more thickly punctate and less shining than the following species (*C. anisotomoides*).

The above description is reproduced from Sturm, as I have not seen the species. It has been taken in Hungary and Austria.

37. *C. anisotomoides*, Spence.

Choleva anisotomoides, Spence, Linn. Trans. xi. 156. 16.

Catops anisotomoides, Sturm, Deutschl. Fn. xiv. 42. 21. t. 278. f. c. C; Heer, Fn. Helv. i. 384. 20; Redt. Fn. Aust. 145. 16; Kraatz, Stett. Ent. Zeit. xiii. 439. 29; Fairm. & Laboulb. Fn. Ent. Fr. i. 304. 20.

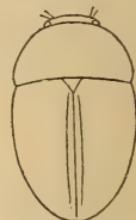
Ovatus, piceus, nitidulus; antennæ longioribus, obsolete clavatis; thorace transverso, basi latiore, margine postico recto, angulis posticis obtusis; elytris piceis seu rufo-piceis.

Long. $\frac{3}{4}$ lin.

Oval, very convex. Pale ferruginous-brown, somewhat shining, variable in depth of colour, deeper on the disk of the thorax and of the elytra, with a fine brown pubescence. Antennæ tolerably long, scarcely thickened at the extremity. Thorax transverse, as broad at the base as the base of the elytra, narrowed a little in front, very densely but finely punctate; posterior margin straight, posterior angles obtuse. Elytra elongate-oval, scarcely widening behind the base, then gradually becoming narrower; densely punctate, but not so finely as the thorax; suture raised; sutural stria deep, almost reaching the scutellum; no traces of other striae to be seen. Legs and antennæ of the same colour as the body.

The smallness of its size, and its short and more convex form, distinguish it from *C. velox*. It is nearer in point of size to *C. præcox*, but the more elongate form of the latter and its dif-

Fig. 38.



ferently shaped thorax distinguish it; and a tendency which it has to curl itself up like an *Agathidium* will suggest what it is.

Distributed over all Europe, and generally common. In Scotland and England it is scarcer; but in France and Germany it is very common. Fairmaire says it is found almost all the year round in vegetable detritus, principally on the banks of lakes and marshes.

Exotic species.

38. *C. marginicollis*, Lucas.

Catops marginicollis, Lucas, Expl. de l'Algérie, Anim. Art. ii. p. 224. pl. 21. fig. 4.

“Capite nigro, granario; thorace subgranario, nigro, ferrugineo marginato, angulis posticis subacuminatis; elytris nigris striatis subtilissimis confertissime punctulatis; corpore infra nigro, subtiliter granario; pedibus antennisque ferrugineis.

“Long. $2\frac{1}{2}$ lin., lat. $1\frac{1}{2}$ lin.

“The head is black, granulated, and scarcely pubescent. The maxillary and labial palpi, as well as the antennæ, are entirely ferruginous. The thorax pubescent, very lightly granulated, black, with the lateral margins ferruginous; it is very gently convex, rounded on the lateral parts, with the angles on each side of the base less projecting, and a little less acuminate than in *C. celer*, Luc. The scutellum is black, granulated. The elytra, of the same colour as the scutellum, pubescent, have a very fine and very dense punctuation; they are striated, and the striæ are sufficiently well marked. All the body below is of a deep brown, and is very finely granulated. The legs are entirely ferruginous*.”

This species was taken by M. Lucas at Oran, in the west of Algeria, under stones, in the end of February.

The outlines of this and the following species are taken from the figures given in M. Lucas' work.

39. *C. rufipennis*, Lucas.

Catops rufipennis, Luc. Expl. d'Algérie, Anim. Art. ii. p. 224. pl. 21. fig. 3.

“Capite nigro, granario; thorace subtilissime granario, nigro, ad latera posticeque rufescente marginato; elytris granariis rufis, ad suturam utrinque unistriatis; corpore infra nigro; pedibus rufis tibiisque fusco-maculatis.

“Long. $2\frac{1}{4}$ lin., lat. 1 lin.

“This is smaller than *C. celer*, from the same country (Algeria), and cannot be confounded with it,

Fig. 39.



Fig. 40.

* Lucas in *loc. cit.*

on account of the colour of its elytra, which are entirely ferruginous. The head is black, granulated. The maxillary palpi, as well as the labial palpi, are reddish. The antennæ are ferruginous, with the last joints a little brownish. The thorax slightly pubescent, very finely granulated, and tolerably convex; black, margined with ferruginous on the sides and behind; the sides are rounded, as are also the angles on each side of the base. The scutellum is black, pubescent, and very finely granulated. The elytra very pubescent, ferruginous; they are finely granulated, striated, and a sutural stria appears pretty deeply impressed on each side of the suture. The whole body below is black. The legs are of the same colour as the elytra, with the thighs marked with brown, and the tibiæ finely denticulated*.”

Met with by M. Lucas on a single occasion, under stones, in the month of January, in the ravines of Djebel Santon, in the neighbourhood of Oran.

40. *C. fungicola*, Kolen.

Catops fungicola, Kolenati, Meletemata Ent. fasc. v. 51.

“ Castaneus, nitidus, pubescens, punctulatus; capite brunneo, antennis pedibusque testaceis.

“ Long. 0·0025, lat. 0·00133.

“ Head blackish-brown, shining, scarcely punctulated; thorax testaceous or chestnut, pubescent, very finely punctulate; elytra convex, chestnut, shining, narrowed behind, rounded, punctulate. Scutellum brown, punctulate.

“ Lives in fungi in the woods of Mount Ssarijal, in the province of Elisabethopolis†.”

This species is unknown to me, and I place it in this group merely from the colour, none of the characters on which I have rested my subdivisions of the genus being mentioned by M. Kolenati.

41. *C. pusillus*, Motsch.

Catops pusillus, Victor Motschoulsky, Bull. Soc. Imp. Mosc. 1840, p. 175.

“ Ovalis, cinnamomeus, sericeo-pubescent; thorace transverso, angulis posticis subproductis, lateribus rotundatis; antennis pedibusque dilutioribus pubescens.

“ Long. $\frac{1}{2}$ lin., lat. $\frac{1}{3}$ lin.

“ One of the smallest species of *Catops*, and covered with a close golden pubescence. The antennæ are a little pilose,



* Lucas in loc. cit.

† Kolenati in loc. cit.

of the length of the head and thorax together, the eighth joint much smaller and shorter than the seventh. The thorax is transverse, rounded on the sides, and when looked at from in front, it appears even a little broader than the elytra; it is cut straight at the base, and has the posterior angles a little projecting backwards. The scutellum is triangular. The elytra are oval, *obliquely emarginate at the extremity towards the suture, with the exterior angle projecting in a point.* On each side of the suture there is an impressed line which reaches a little beyond the half of the elytra. The anterior tibiae are a very little dilated*."

The emargination of the elytra at the apex of the suture furnishes an easy character for distinguishing this species.

M. Motschoulsky mentions that he took it in spring at Ananur, on the great military route of Georgia, and in the month of August, near Davial, on the same route. It was found under stones, and in the earth, among roots, in obscure places. The specimens which have been recently excluded are often of a testaceous colour.

42. *C. pallidus*, Menetries.

Catops pallidus, Menetr. Cat. rais. des Obj. de Zool. rec. dans un Voyage au Caucase, &c., p. 169.

" Oblongo-ovatus, subdepressus, ferrugineus, breviter griseo-pubescent; elytris obsolete punctulatis, apice subacuminatis.

" Long. 2 lin., lat. $1\frac{1}{4}$ lin.

" Found at Bakon†."

The above meagre description is all that we know of this species; it would, however, rather appear to belong to this group.

43. *C. Dauricus*, Motsch.

Catops Dauricus, Motsch. Remarques sur la Collection de Col. Russ. de V. de Motschoulsky in Bulletin de Moscou, vol. xviii. 1845.

" Testaceo-ferrugineus; thorax angustior quam elytra.

" A species remarkable on account of its thorax being much narrower than the elytra, which are of a tolerably broad oval, and acuminate at the extremity. The *facies* approaches nearly the genus *Pteroloma*, but the body wholly removes it. It is of a ferruginous-yellow colour, and is found on the summits of the alps of Hamar-Daban in Mongolia‡."

* Motschoulsky in *loc. cit.*

† Motschoulsky in *loc. cit.*

‡ Menetries in *loc. cit.*

I have not seen this species in nature, and the above description is too short to enable us to form an accurate idea of its form or affinities.

44. *C. basilaris*, Say.

Catops basilaris, Say, Journ. Acad. Philadelphia, iii. 194.

“ *Niger, brevissima flavescente pubescentia vestitus; elytris brunneis, pallidioribus ad basin.*”

“ Long. $1\frac{1}{2}$ lin.

“ Body black, covered with numerous short yellowish hairs; eyes fuscous; antennæ blackish, two basal joints yellowish-white; eighth joint very small, transverse, shortest; the seventh and three terminal joints largest, the latter somewhat piceous; thorax transverse, quadrate, convex, rather narrower before; lateral edge regularly arcuated, basal and anterior edge subrectilinear; angles rounded; scutellum triangular; elytra brownish, paler at base; a distinct subsutural impressed line; labrum and palpi pale piceous, beneath blackish piceous; feet dark piceous.

“ Found under wood at Engineer Cantonment, on the Missouri*.”

I believe it is not known what species Say had in view in describing this. Dr. Leconte, whose knowledge of American entomology is perhaps greater than that possessed by any other naturalist, includes it, in his ‘Synopsis of the *Silphales* of America,’ among those which were unknown to him. Say’s description, I think, seems to point either to an affinity with *C. tristis* or *C. fumatus*, and I place it in this group with doubt.

45. *C. opacus*, Say.

Catops opacus, Say, Journ. Acad. Nat. Sc. Philad. v. 184; Leconte, Syn. Silph. Amer. in Proceedings of Acad. Philad. (1853) 280.

“ *Ater, punctulatus, subtiliter pubescens; thorace semi-elliptico, basi late rotundato; elytris obsolete striatis; tibiis calcaribus magnis armatis.*”

“ Long. 2 lin.

“ New York and Ohio: rare.

“ The male has three joints of the anterior tarsi strongly dilated; the middle tarsi are not dilated. The sutural stria of the elytra is deeper than the others†.”

* Say in *loc. cit.*

† Leconte in *loc. cit.*



46. *C. terminans*, Leconte.

Catops terminans, Lec., Agassiz, Lake Superior, 218; Lec. Synops. Silph. N. Amer. Proc. Acad. Philad. vi. 1853, 282.

“ Oblongo-ovalis minus convexus, nigro-piceus, subtiliter Fig. 43. pubescens; elytris distinctius rugose punctulatis, stria suturali profunda; thorace breviore, anterius valde angustato, angulis posticis vix productis; pedibus fuscis; antennis apice flavis, basi testaceis.

“ Long. 1 lin.



“ Very abundant at the mouth of the Pic river, on the north side of Lake Superior, under dried animal matter. This species is broader and less convex than *C. consobrinus*, and is easily known by the more distinct punctuation, and by the absence of the transverse lines. The thorax is densely and finely punctulate; it is about twice as wide as its length, strongly narrowed in front, rounded on the sides, especially anteriorly, slightly emarginate at apex, truncate at base, and very slightly sinuate at the posterior angles, which are scarcely perceptibly acute. The anterior tarsi of the male, and the first joint of the middle tarsi, are dilated*.”

47. *C. monilis*, mihi.

Oblongo-ovalis, fuscus; antennis capite et thorace longioribus, articulo octavo minutissimo, *articulis ante sextum non gradatim crescentibus magnitudine*, fuscis, articulo ultimo et articulis ad basin ferrugineis; thorace leviter, elytris fortiter transverso-strigosis, his stria suturali impressis; pedibus spinosis.

Long. $1\frac{1}{2}$ lin., lat. $\frac{3}{4}$ lin.

Fig. 44.



Oblong-oval, nearly of the same size and form as *C. alpinus*, brown, a little darker behind and on the middle of the thorax. The antennæ are longer than the head and thorax; the basal joints (first, second, third, fourth and fifth) and the last joint are ferruginous-yellow; the seventh, eighth, ninth and tenth joints blackish-brown; first joint large, and longer than second; second thin and slender, a little longer than third; third, fourth and fifth thin and slender and very short, nearly all of equal length; sixth shorter than these, but rather broader; seventh largest and broadest of the whole; eighth excessively minute; ninth and tenth of equal length and thickness, rather narrower than the seventh, their sides more parallel than is the case in other species; eleventh of the same breadth as the two preceding. Head

* Leconte in *loc. cit.*

broad, rugosely punctate; mouth broad, concolorous. Thorax pale on the margins, lightly transversely strigose. Elytra more decidedly transversely strigose, with the suture and a sutural stria somewhat depressed, and indistinct traces of striæ towards the apex. Scutellum equilaterally triangular, somewhat depressed, clothed all over with a concolorous fuscous pubescence; beneath the pubescence the surface is somewhat shining; under side and legs fuscous-brown, paler than above; tibiæ slightly and delicately spinous, middle tibiæ slightly bent.

This species has very much the appearance of *alpinus*, but the structure of the antennæ is different. They are longer than in that species. The club also does not gradually increase in thickness from the first joint onwards till it reaches its greatest breadth at the seventh, and then taper away again, as in *alpinus*; the club from the eighth joint to the middle of the last joint is of equal thickness, giving a somewhat moniliform appearance to the club, from which character I have given its name. In *alpinus* the third joint is thicker and longer than the second, while here it is smaller and slenderer. In *alpinus* the fourth, fifth, sixth and seventh joints go on increasing in thickness, while here the third, fourth and fifth form a narrow slender peduncle, all being of nearly equal size; the sixth and eighth joints here are much smaller than in *alpinus*. The pubescence in this species is also darker and duller and more sparing than in *alpinus*.

It was found at Caraccas by M. Sallé, and presented to me by his relative M. Chevrolat.

48. *C. spinipes*, mihi.

Elongato-ovalis, fuscus; antennis capite et thorace vix longioribus, *articulis ante sextum gradatim crescentibus magnitudine*, fuscis, articulis ultimis et primis pallidioribus; thorace leviter et elytris fortiter transverso-strigosis, his stria suturali impressis; pedibus spinosis.
Long. 1 lin., lat. $\frac{1}{2}$ lin.

Fig. 45.



A good deal smaller than the preceding (*C. monilis*), to which it has considerable resemblance, but is more elongate in form. The antennæ are not quite so thick; the joints do not continue thin, short and slender from the second to the sixth, but go on increasing in breadth from the second to the seventh; the second and third are nearly of equal length; the fourth and fifth are each shorter than the third, and gradually but slightly increase in breadth; they are all of nearly the same length; the sixth is shorter than the fifth, but not very minute; the

seventh is the largest joint in the antenna ; the eighth is minute, but not nearly so much so as in *monilis* ; the ninth is as broad but shorter than the seventh ; the tenth is a little narrower than the ninth, and the eleventh a little narrower than the tenth, otherwise they are nearly of the same size. The antennæ are brown, with the exception of the two first joints which are clear ferruginous, and the three last which become gradually paler to the tip. The head and mouth are broad ; the former is rugosely punctate and darker than the rest of the body. The thorax is short, darkest in the middle, transversely rugose. The elytra are very distinctly transversely strigose ; there is a sutural stria impressed on them. The scutellum is small, elongate triangular, depressed, and darker than the elytra. The whole body is covered with a dense fuscous pubescence of the same colour throughout, but throwing a reflexion like a lighter band across the elytra towards the apex when viewed in certain lights. The under side is of the same colour as the upper. The legs are paler ; they are very distinctly spinose, a character which is found in other species, but which, from being very marked here, I have taken to furnish a suitable name to the species. The middle tibiae are a little bent. In the males the anterior tarsi are widened, but the middle tarsi are not.

Found at Caraccas by M. Sallé, and presented to me by M. Chevrolat.

Group III.

Mesosternum keeled ; middle tarsi alike in both sexes.

1st Subdivision. *Body polished and shining ; the elytra not transversely strigose.*

49. *C. lucidus*, Kraatz.

Catops lucidus, Kraatz, Stett. Ent. Zeit. xiii. 439. 30.

“ Oblongo-ovatus, nigro-piceus, *nitidus* ; antennis pedibusque ferrugineis ; thorace transverso, basi latiore lævi ad angulos obtusos utrinque distincte sinuato ; elytris flavo-testaceis, apice piceis, passim minus profunde punctatis.

“ Long. $1\frac{3}{4}$ lin.”

Not having seen this species, I can only reproduce M. Kraatz's description, which is as follows :—

“ A new species differing so much from all the species of *Catops* known to me, by its shining glittering upper side and clear yellow elytra, that I cannot class it under any one of Erichson's groups : not only so, but I was not wholly averse to have based a new genus upon it, if in spite of the many differ-

ences there was not a form of transition to that of the perfect *Catops* in a species which I possess (the only one hitherto accessible), and a species from Mesopotamia in the Royal Museum (of Berlin) (though in other respects differing little from the *C. lucidus* of this country). The antennæ are nearly of the length of the elytra, entirely of a lively reddish-brown, stout; first joint distinctly longer than the second, and as well as it a little more slender than the remaining joints; third a little stouter than the fourth, nearly as long as the first; fourth, fifth and sixth are reverse cone-shaped, the following joint always somewhat shorter than the preceding; the seventh is equal to the ninth and to the tenth in length, which is the same as the length of the fourth joint, but somewhat stouter; the eighth is somewhat shorter but scarcely more slender than the joints which encompass it; the eleventh is almost of the length of both the preceding, from its base to its last third growing gradually broader, from thence cone-shaped acuminate. The head is black, shining, not punctate; the mouth yellowish-red. The thorax at the base is more than double as broad as long, gradually narrowed from the base towards the front, so that the greatest breadth is before the middle*, gently rounded on the sides; the anterior angles are obtuse, somewhat sloping downwards, the posterior angles likewise obtuse and rounded off; the posterior margin is distinctly sinuate and depressed over the moderately densely finely punctate scutellum, and on each side towards the posterior angles, so that the posterior angles project slightly and are a little reflexed; the upper side is dark pitchy-brown, clearer on the sides and posterior angles, flatly arched, bright shining. The elytra are symmetrical oblong, only feebly narrowed behind, shining pale yellow, brownish towards the scutellum, dark pitchy-brown at the apex, disappearing at some distance, with punctures irregularly arranged in rows and clothed with solitary yellowish hairs; the under side is shining black, not punctured, the last abdominal segment yellow. The legs are lively reddish-brown.

“One example from Kuhr, probably found in Dalmatia†.”

I am unable to give any description of the species from Mesopotamia above referred to by M. Kraatz.

* *Sic in orig.*, viz. “von der Basis an nach vorn allmälig verengt, wodurch die grösste Breite vor der Mitte.” It should probably have been, “greatest breadth behind the middle.”

† Kraatz in *loc. cit.*

50. *C. cryptophagooides*, Mannerheim.

Catops cryptophagooides, Mann. Bull. Soc. Imp. Mosc. 1852, pt. 2. p. 333.

“Oblongo-ovatus, convexus, rufo-ferrugineus, nitidus, glaberrimus; antennis extrorsum valde incrassatis pilosis, articulo octavo præcedente multo minore; thorace lævi, antrorsum rotundato, angulis posticis supra elytra rotundato-productis; elytris disperse punctatis, subrugulosis.

“Long. $\frac{2}{3}$ lin., lat. $\frac{1}{3}$ lin.*”

I have not seen this species. M. Pippingsköld collected it in the island of Sitka under a stone.

Mannerheim states that in form it comes very near the genus *Colon*, but he rather referred it to *Catops* from the structure of the antennæ, although at the same time differing from both by the polished smoothness of its body. From this indication it should probably rank beside *lucidus*, Kraatz, and I have accordingly placed it in this subdivision.

2nd Subdivision. *Body not polished and shining; elytra transversely strigose.*

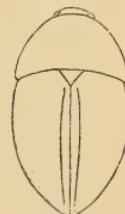
51. *C. strigosus*, Kraatz.

Catops strigosus, Kraatz, Stett. Ent. Zeit. xiii. p. 441. 31.

Fig. 46.

Ovatus, rufo-ferrugineus; antennis longioribus, obsolete clavatis, ferrugineis; thorace transverso, angulis posticis fere acuminatis; elytris substriatis, evidenter transversim strigosis, apice acuminatis.

Long. $1\frac{1}{2}$ lin.



The antennæ are slender, entirely reddish-brown; first, second and third equal in length; fifth scarcely longer than those on each side of it, half as large as the first joint; seventh somewhat longer and stouter than the foregoing, equal to the ninth and tenth; eighth scarcely half as long and a little thinner than the seventh; eleventh somewhat longer than the tenth, moderately sharply acuminate. The head is red-brown, densely and finely punctate. The thorax is nearly $2\frac{1}{2}$ times as long as broad; at the base it is of the same breadth as the elytra; it is gradually narrowed towards the front, gently rounded on the sides; the upper side is moderately densely clothed with golden-yellow pubescence, coarsely granulated; the anterior angles are obtuse,

* Mannerheim in *loc. cit.*

sloping downwards; the almost pointed posterior angles project pretty strongly backwards embracing the elytra, so that the posterior margin appears to be strongly sinuated on both sides near the elytra. The elytra are oval, strongly narrowed from the middle towards the apex, each tolerably sharply acuminated, moderately densely and finely pubescent, and deeply transversely strigose, with distinct traces of longitudinal striæ. Under side and legs reddish-brown.

Kraatz says it is of a reddish colour, but the only specimen I have seen was black.

Of the form of the *C. velox*, Spence, approaching most to it, but a little smaller, more acuminate behind, and easily recognizable by its keeled mesosternum; distinguished from the following species by its different form and longer antennæ; and from *C. acicularis*, Kraatz, the only other species of the preceding groups which has transversely wrinkled elytra, by its smaller size and shorter and broader form.

Found in Austria: extremely rare.

52. *C. validus*, Kraatz.

Catops validus, Kraatz, Stett. Ent. Zeit. xiii. 441. 32.

“Oblongo-ovatus, niger, fusco-sericeus; antennis rufo-piceis, clavatis; thorace, elytrisque transversim strigosis, apice truncatis. “Long. $2\frac{1}{2}$ lin.

“This distinct species comes near the following in the form of the body, and only deviates from them by its greater size and the different structure of the antennæ. I confine myself therefore to describing the latter more strictly.

“Antennæ reddish-brown; first joint at least twice as long and half as strong again as the second, somewhat more slender at the base; second very small, at the end nearly as broad as long, somewhat more slender at the base; *third at least three times as long as second*, for the last third part becoming gradually somewhat broader; *fourth equal in length to second*, but somewhat broader; *fifth equal to fourth*; *sixth somewhat shorter and broader than the eighth*; *seventh somewhat shorter, but just as broad as the ninth*; *eleventh distinctly more slender and half as long again as tenth*; from the base to the apex conical acuminate, somewhat paler at the tip. Agreeing in other respects with the following species.

“Two examples from Stentz in Hungary are in the Royal Museum, under the name of *C. validus**.”

* Kraatz in *loc. cit.*

Not having seen this species in nature, I have merely copied the description of Kraatz. In size it is a third larger than the following species; but although that of itself would not be sufficient to constitute it a distinct species, the differences in the structure and proportion of the joints of the antennæ are too great to allow us to hesitate in according it a place as such. The principal differences in these proportions have been printed in italics in the respective descriptions of the antennæ of these species.

53. *C. sericeus*, Fabr.

Catops sericeus, Fabr. Syst. El. ii. 564. 2; Erichs. Käf. d. M. Br. i. 243. 16; Sturm, Deutschl. Fn. xiv. 43. 22. t. 278. f. d. D; Heer, Fn. Helv. i. 384. 21; Redt. Fn. Aust. 143. 1; Kraatz, Stett. Ent. Zeit. xiii. 442. 34; Fairm. & Laboulb. Fn. Ent. Fr. i. 305. 21.

Helops sericeus, Panz. Fn. Germ. 73. 10.

Ptomaphagus truncatus, Illig. Mag. i. 42. 4.

Catops truncatus, Gyll. Ins. Suec. i. 279. 3.

Choleva villosa, Latr. Gen. Crust. et Ins. ii. 29. 5; Spence, Linn. Trans. xi. 152. 12.

Mycetophagus picipes, Kug. Schneid. Mag. 558. 9.

Mordella silphoides, Marsh. Ent. Brit. i. 493. 19.

Var. minor. *Catops sericatus*, Chaud. Bull. de Mosc. 1845, no. 3. 199.

Oblongo-ovatus, niger, fusco-sericeus; antennis brevioribus, nigro-piceis, *ad basin ferrugineis*; thorace elytrisque transversim strigosis, his apice truncatis.

Long. $1-1\frac{1}{2}$ lin.

Oval, a little depressed above, of a deep blackish-brown, very silky. Antennæ about as long as the thorax, perceptibly thickened towards the extremity; first joint twice as long as the second; *second and third nearly equal in length and thickness; fourth and fifth nearly equal in length, each shorter than second or third; sixth about the same length as fifth, but decidedly broader, twice as long as eighth, and not so broad; seventh a very little longer and much broader than sixth; eighth less than half as long as seventh, and scarcely less broad; ninth and tenth each about the same length as seventh, but broader; eleventh more slender and half as long again as tenth, and only commencing to be acuminate past its middle; the apex obtuse, reddish-brown, lighter at the base, deeper at the apex.* Head black, large, finely punctate. Thorax shining black, finely transversely wrinkled, a little broader than long, somewhat narrowed in front; posterior angles pointed, projecting backwards, which makes the posterior margin broadly

Fig. 47.



arched. Elytra of a brown, more or less dark, finely transversely strigose, becoming narrower from the base to the extremity, which is obliquely truncate. Legs brown; thighs often blackish. Size very variable.

Distinguished at first sight from all the allied species, except *varicornis* and *validus*, by its truncate elytra. From *C. varicornis* it is distinguished by the apex of the antennæ not being light-coloured, and from *C. validus* by its smaller size and by the different proportions of the joints of the antennæ.

Common in Britain, and generally distributed all over Europe.

54. *C. varicornis*, Rosenhauer.

Catops varicornis, Rosenh. Beitr. zur Ins. Fn. Eur. i. 23; Kraatz, Stett. Ent. Zeit. xiii. 442. 33.

Oblongo-ovatus, niger, fusco-sericeus; antennis brevioribus, *basi apiceque ferrugineis*; thorace elytrisque transversim strigosis, his apice truncatis.

Long. $1\frac{1}{2}$ lin.

Closely allied to *C. sericeus*, and principally distinguished by the form and colour of the antennæ, which are shorter and ferruginous both at the base and the apex, and the beetle is usually somewhat darker. The head is broad, finely punctate, shining black with a grey pubescence; the mouth ferruginous-red. The antennæ scarcely reach beyond the half of the thorax, and are thickened on the outer side so as to be distinctly club-shaped. The individual joints are as in the *C. sericeus*, but form a rounder oblong and thicker club. The first five joints are ferruginous-red, those following brownish; the eighth shorter but not more slender than the remainder; the last transverse, short, and very obtuse, much shorter than in the *C. sericeus*, and reddish-yellow. The thorax is large, black, shining, clothed with a silky pubescence, almost square, a little broader than long, of the breadth of the elytra, somewhat narrowed in front, gently rounded on the sides; the posterior angles pointed, projecting slightly backwards, the posterior margin rounded. The scutellum is large, triangular, transversely strigose. The elytra are dark brown, finely transversely strigose, a little arched, somewhat rounded on the sides, moderately narrowed towards the extremity, not so strongly truncate at the apex as in *C. sericeus*, and more rounded, with a fine brownish pubescence. The under side is black; the legs are brown, the tarsi paler.

The pale terminal joint of the antennæ, combined with the general appearance of *C. sericeus*, at once indicates this species.

It is also a deeper insect than *sericeus*, and the sides more nearly approach the perpendicular.

Described by Rosenhauer from three specimens found at Stettin. It has since been found in other parts of Germany, and no doubt is scattered all over the continent. I have not found it in Scotland, but it has been taken by Mr. Guyon near Richmond, and by Dr. Power near London.

Chaudoir's *C. sericatus* is said by Kraatz to be only a small variety of this species. I have not seen it, but I have no doubt he is correct. Chaudoir's description contains no character sufficient in my view to support the establishment of a new species. His description is as follows:—" *C. sericatus*, hitherto confounded with *C. sericeus*. It is constantly three times smaller, more narrowed behind; the elytra narrower; the wrinkles above less marked; the antennæ less enlarged towards the extremity, the last joints more elongate, the eighth a little narrower, the last less obtuse, and of the colour of the preceding. The breast is less convex; the colour of the elytra is lighter towards the extremity, which is almost ferruginous.

"Found at Kiew in spring, under dry leaves at the foot of trees*."

55. *C. colonoides*, Kraatz.

Catops colonoides, Kraatz, Stett. Ent. Zeit. xii. 169. 35.

Oblongo-ovatus, fusco-sericeus; antennis obsolete clavatis, ferrugineis; thorace elytrisque transversim strigosis, his non truncatis.

Long. $\frac{7}{8}$ lin.



The antennæ are about the length of the head and thorax, imperceptibly thickened towards the point, ferruginous-red; the seventh joint scarcely broader, but at least twice as long as the preceding, always darker-coloured than the remaining joints; the eighth joint somewhat smaller than the sixth; the ninth, tenth, and the acuminate eleventh tolerably equal in size. The head is blackish-brown, finely punctate, with a grey pubescence. The thorax is blackish-brown, somewhat lighter on the extreme posterior margin, extremely densely and finely granulated, about a fourth broader than long, narrowed in front, moderately rounded on the sides; the posterior angles are sharp, projecting backwards. The elytra are dark brownish, towards the apex lighter, finely transversely strigose, covered

* Chaudoir in *loc. cit.*

with a fine silky brown down, gradually narrowed towards the apex. The under side is blackish-brown, the margins of the individual abdominal segments lighter; the legs are ferruginous-brown. Nearly constant in size.

A very distinct species, similar to *C. sericeus*, and, like it, with transversely wrinkled elytra, but smaller than the smallest individuals of that species, and easily distinguished by the wholly different form of the antennæ, by the gradually narrowed and not truncate elytra, and the stronger more distant transverse wrinkling. The club of the antennæ is as a rule somewhat darker, the last joint somewhat larger than the preceding, cone-shaped, acuminate.

Kraatz says that it is taken near Berlin in loose sand at the foot of old oak-trees, and that it is frequent in moors.

Exotic species.

56. *C. suturalis* (Motsch.) mihi.

Affinis C. sericeo, sed elongatior, lateribus minus rectis, et thorace forma breviore; elytris longioribus. Long. $1\frac{1}{8}$ lin.

Fuscous; head and thorax with fulvous sericeous pubescence; elytra ferruginous-brown, with the anterior half of the sutural margin and the margins of the elytra darker; inflexed margins of elytra and margins of under side of thorax clear ferruginous, remainder of under side pitchy-black; legs ferruginous. Antennæ with base ferruginous, club and apex dark; first joint large and long; second not so long; third and fourth of nearly the same length; fifth shorter than fourth; sixth shorter than seventh; seventh large and broad; eighth very small; three last nearly of the same size. Thorax faintly transversely strigose, posterior angles obtuse. Elytra deeply transversely strigose. Scutellum elongate. Sutural stria shortened, joining the suture at about one-third from the apex. Elytra truncate at the apex; pubescence on elytra darker than on thorax.

This species has a great resemblance to *C. sericeus*, but differs from it in the following particulars. In general outline it is scarcely broader in front than behind, while *sericeus* is usually markedly so. The thorax begins to round-in towards the head almost immediately from the base forward, while in *sericeus* it does not begin to turn inwards till about the middle of the

Fig. 49.



thorax. Scutellum more elongate than in *sericeus*. The length of the elytra is $2\frac{1}{2}$ times that of the thorax, while in *sericeus* it is not so much as twice that length. The elytra also are not so broadly truncate at the apex.

Described from a specimen in M. Chevrolat's collection received under this name from M. Motschoulsky. Locality not mentioned; supposed to be from Mongolia.

57. *C. californicus*, Leconte.

Catops californicus, Lec. Synopsis of Silphales of N. America, Proc. Acad. Philadelphia, vol. vi. 1853, p. 281.

Oblongus, subovalis, piceus, sericeus, subtilissime punctulatus et transversim strigosus; antennarum basi, pedibus, elytrisque pallidioribus, his stria suturali profunda; thorace antrorsum valde angustato, angulis posticis paulo productis subacutis.

Long. 1 lin.

The antennæ are slightly clavate and as long as the head and thorax; the thorax is strongly narrowed in front, truncate at base, and slightly sinuate near the posterior angles, which are subacute; the sides are broadly rounded; the disk is sometimes blackish, and the sides dark rufous. The punctures of the upper surface in this species are very indistinct, and the transverse striae very fine; the pubescence is sericeous, but not dense; the anterior tarsi of the male are strongly dilated, the intermediate pair simple, the posterior pair longer than the tibiae.

Dr. Leconte mentions that it is abundant at San Jose and San Diego, California. He also observes that one female specimen which he had from San Diego appeared more elongated than the others and much more narrowed posteriorly. He could not, however, find any other difference.

58. *C. consobrinus*, Leconte.

Catops consobrinus, Lec. Syn. Silph. N. Amer. Proc. Acad. Philad. vi. 1853, p. 281.

“ Oblongo-ovalis, subelongatus, ater, subsericeus, vix punctulatus, subtiliter transversim strigosus; antennis basi rufo-piceis; elytris stria suturali profunda; thorace antrorsum modice angustato, angulis posticis leviter productis.

“ Long. 1 lin.

“ Georgia. This species resembles the two preceding, but is a little more elongated and more oval; it is entirely black, except-



ing the base of the antennæ and the tarsi, which are rufo-piceous. The thorax is more than one-half wider than long, moderately narrowed in front, broadly truncate at apex, very slightly rounded on the sides, truncate at base, and faintly sinuate at the posterior angles, which are slightly acute. The punctures are very indistinct. The transverse scratches are as fine as in *C. californicus**.”

59. *C. Lecontei*, mihi.

Catops strigosus, Lec. Syn. Silph. N. America, Proc. Acad. Philad. vol. vi. 1853, p. 281.

“ Oblongo-ovalis, subelongatus, piceo-rufus, sericeus, Fig. 52. distinctius strigosus; thorace latitudine sesqui breviore, antrorsum modice angustato, angulis posticis vix productis, subacutis; elytris stria suturali profunda; antennis magis incrassatis, piceis, basi testaceis.



“ Long. 1 lin.

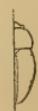
“ One female, South Carolina, Dr. Zimmerman. This species resembles the preceding, but the thorax is less narrowed in front and less rounded on the sides; the transverse lines on the thorax and elytra are more distinct; the punctures are very indistinct; the first four or five joints of the antennæ are testaceous, the rest are piceous; the apex is indistinctly paler†.”

The “Synopsis of the Silphales of America north of Mexico,” in which this species was described by Dr. Leconte under the name of *strigosus*, was published in February 1853, while M. Kraatz’s description of the European species so named by him was published in the ‘Stettin Ent. Zeitung’ in 1852. By the rule of priority therefore, the name *strigosus* must be retained for Kraatz’s species, and another name given to this. It appears to me that it is an appropriate homage to name it after the eminent naturalist who first described it.

60. *C. oblitus*, Leconte.

Catops obesus, Lec. Syn. Silph. N. Amer. Proc. Acad. Philad. vi. 1853, 282.

“ Subellipticus minus convexus, rufo-fuscus, pubescens; thorace punctulato antrorsum subangustato basi truncato, angulis posticis fere obtusis; elytris transversim minus dense strigosis, stria suturali distincta; antennis flavis, art. 4-10 fuscis.



“ Long. 1 1/2 lin.

* Leconte in *loc. cit.*

† Leconte in *loc. cit.*

"Three specimens, Georgia. Easily distinguished by its sub-elliptical and less convex form. I cannot discover any punctures on the elytra; if they exist they are concealed by the dense pubescence, which is however scarcely sericeous. The male has three joints of the anterior tarsi dilated; the middle tarsi are simple in both sexes*."

The mesosternal keel is less elevated in this and the next than in the other species.

61. *C. parasitus*, Leconte.

Catops parasitus, Lec. Syn. Silph. N. Amer. Proc. Acad. Philad. vi. 1853, p. 282.

"Breviter ovatus, piceo-rufus, sericeus; thorace disco Fig. 54. obscureo, brevi, antrorsum valde angustato, angulis posticis non productis; elytris transversim strigosis, stria suturali profunda; antennis basi apiceque flavis.



"Long. $\frac{3}{4}$ lin.

"New York, in ants' nests, with *Hæterius brunnipennis*, March and April. This species is much broader and more suddenly narrowed posteriorly than the others. The thorax is fully twice as wide as its length, punctulate, not strigose, strongly narrowed in front, broadly rounded on the sides, truncate at base, with the posterior angles simply rectangular and not produced. The elytra are punctulate and distinctly striate transversely. The antennæ are as long as the head and thorax, very slightly incrassated, rufo-piceous, with the first four joints and the apical one yellowish; the seventh joint is more than twice the length of the sixth; the eighth joint is much shorter, but scarcely thinner than the following ones. The anterior tarsi of the male are broadly dilated; the first joint of the middle tarsi is less dilated than in *C. terminans*†."

The mesosternal keel is finer and less raised in this and *C. oblitus* than in the other species.

62. *C. a-scutellaris*, mihi.

Oblongo-ovatus, fusco-sericeus; antennis vix ad apicem Fig. 55. incrassatis, fuscis, basi apiceque ferrugineis; thorace elytrisque leviter transversim strigosis, his stria suturali impressis; scutello inviso.



Long. $\frac{7}{8}$ lin.

Fuscous-brown. The antennæ are scarcely so long as the head and thorax, so slightly clavate as to be almost

* Leconte in *loc. cit.*

† Leconte in *loc. cit.*

filiform, fuscous, the basal joints ferruginous, the two apical joints pale; first and second joints long and slender, those following short, gradually though very slightly increasing in breadth up to the seventh; the seventh is rather shorter than the ninth, and of about the same thickness; the eighth is not narrower than those on each side of it, but shorter, being about half the length of the ninth; the ninth and tenth are equal in length and thickness; the eleventh is larger than the tenth, and becomes acuminate towards the point. The head is darker than the rest of the body. The thorax forms a continuous or nearly continuous line with the elytra; its posterior angles do not project behind; both thorax and elytra are seen under a powerful lens to be very finely though distinctly transversely strigose. The elytra are not truncate, although they are rounded rather rapidly at the apex. The scutellum is not visible. The sutural stria is distinct at the base, but it draws closer to the suture as it proceeds to the apex, and is lost before it reaches it. Under side and legs ferruginous-brown.

From Caraccas. I received this species from M. Deyrolle, under the manuscript name of *æquinoctialis*; but the advantage of having a name bearing reference to some particular character, when that can be had, is so obvious, that I am sure that that excellent entomologist will excuse my not adopting the name he had destined for it.

63. *C. australis*, Erichs.

Catops australis, Erichson, Wieg. Arch. (1842) p. 243.

Mesosterno carinato, niger, nigro-pubescent; thorace Fig. 56.
elytrisque transversim strigosis.

Long. $1\frac{1}{2}$ lin.

Oval, lightly convex, black, with black pubescence. Antennæ of the length of the head and thorax, the apex slightly thickened, the eighth joint narrower than those next it, black, piceous at the base. Thorax about the same breadth as the elytra, with the sides lightly rounded, the posterior angles slightly projecting obliquely behind, nearly right-angled; the base subsinuate on each side, finely transversely strigose. Elytra transversely feebly strigose, the strigations rather widely separated, impressed with a sutural stria, rounded at the apex. Legs concolorous, tarsi piceous, the anterior lightly dilated at the base in the males. Mesosternum slightly keeled.

This species seems to come between *strigosus*, Kraatz, and *sericeus*.



It is found in Tasmania, and is the only species yet recorded from the southern part of the hemisphere.

Genus *CATOPTRICHUS*, mihi.

Antennæ of eleven joints, the last eight of which are strongly serrated in the males, somewhat less so in the females; the three first are slender; the eighth joint is very slightly, if at all, narrower or shorter than those on each side of it. In other respects the characters do not differ from those of *Catops*.

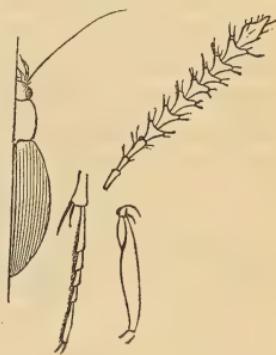
1. *C. Frankenhæuseri*, Mann.

Catops Frankenhæuseri, Mann. Bull. Soc. Imp. Mose. 1852, pt. 2. p. 332.

Elongatus, fusco-piceus, griseo-pubes-
cens; antennis pectinatis, basi ferru-
gineis, articulo ultimo pyriformi apice
acuminato; thorace quadrato, angulis
rotundatis, obsolete canaliculato, pos-
tice in medio impresso; elytris ob-
longo-ellipticis, subtilissime punctu-
latis, tenue striatis, stria suturali pro-
fundiore, rufo-testaceis, cinereo-holo-
sericeis, pilis longis fuscis præsertim
in margine obsitis; pedibus ferru-
gineo-piceis.

Long. $2\frac{1}{2}$ -3 lin., lat. $1\frac{1}{4}$ - $1\frac{1}{2}$ lin.

Fig. 57.



Elongate, having a good deal the form of the first group (subg. *Choleva*) of the genus *Catops*: fuscous, clothed with a griseous pubescence. Antennæ pectinated, black, ferruginous at the base; the first three joints slender; third longer than second; fourth to tenth each of nearly equal length, globose, with a long spine proceeding outwards. Thorax quadrate, angles rounded, obsoletely canaliculated, impressed behind in the middle. Elytra oblong-elliptic, very finely punctulated, feebly striated, the sutural stria deeper, rufo-testaceous, with a cinereous bloom and clothed with long brown hairs, especially on the margin; legs dark ferruginous.

Inhabits the island of Sitka. Several specimens were taken by M. Frankenhæuser in a human body lying in a wood, and in putrid fungi.

I owe the above figure to Dr. Leconte.

Genus **CATOPSIMORPHUS**, Aubé.

Catopsimorphus, Aubé, Ann. Soc. Ent. France, 2 séér. vol. viii. p. 324.

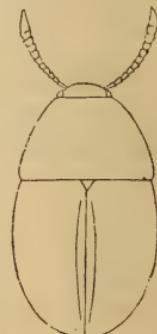
“ Antennæ with eleven joints, very much flattened ; the eighth not narrower and scarcely shorter than the seventh and ninth. Epistome cut almost straight. Labrum broadly and deeply emarginate, and provided in front with a small very slender membrane, strongly emarginate in the middle and ciliated in the emargination. Mandibles denticulated at the extremity and furnished within with a ciliated membrane. Maxillæ with the internal lobe terminated by a small hook ; the external lobe obtuse and hairy at the extremity. Maxillary palpi with four joints, the first very small, the second slightly clavate, the third obconic, the last conical, a half smaller than the third. Labium membranous, pretty deeply emarginate. Labial palpi with three cylindrical joints, the last smallest. Tarsi with five joints, the anterior and middle probably dilated in the male. The facies of this genus is completely analogous to that of *Catops*. It differs from it principally in the form of the antennæ. We know nothing of its mode of life*.”

1. *C. orientalis*, Aubé.

Catopsimorphus orientalis, Aubé, Ann. Soc. Ent. Fr. 2 séér. viii. 325.

“ *Ovalis*, convexiusculus, niger, griseo-pubescent ; antennis, ore, elytris pedibusque ferrugineis ; thorace antice angustato, angulis omnibus rotundatis.— $3\frac{1}{2}$ mill.

Fig. 58.



“ Head black, somewhat brilliant, tolerably broad, very finely punctate and slightly pubescent. Labrum, palpi and antennæ testaceous ; the latter with the first joint longish, cylindrical ; the second almost globular ; the remainder transverse, flattened and gradually increasing in size to the last, which terminates in a point ; the eighth scarcely shorter than the seventh and ninth. Thorax black, pubescent and finely punctate and reticulated, more than one and a half times broader than long, much narrower in front than behind, cut almost straight at the apex and the base, very broadly rounded at the sides ; the anterior and posterior angles obtuse and rounded. Elytra as broad as the thorax at the base, about one and a half times longer than broad ; broadly rounded behind ; ferruginous, less finely punctate

* Aubé in *loc. cit.*

and reticulated than the thorax ; pubescent and marked with a deeply impressed stria on each side of the suture. Under side of body black, with the extremity of the abdomen somewhat ferruginous. Legs ferruginous ; thighs slightly brown*."

Dr. Aubé mentions that he had two individuals of this species, both taken in the neighbourhood of Constantinople. He supposes them to be both females from their having all their tarsi simple.

Since the first part of this paper was in print, I have had an opportunity of carefully examining the specimens in the collection of the Count Dejean, now belonging to the Marquis de Laferté Senectère, who kindly placed them in my hands for that purpose ; and it may be desirable that I should state the result of my examination in reference to the names used by Count Dejean and published in his Catalogue. The specimens are for the most part in good order and preservation. A few, however, were in a less satisfactory state, and of course I give my opinion of these with doubt. As might be expected in such a difficult genus, there were sometimes more than one species placed under the same name, so that it is a matter of opinion which was the typical species he intended to designate.

The names in the collection correspond with those published in the 3rd edition of his Catalogue, 1837. His

Catops rufescens = *C. angustatus*, Erichs.

— *oblongus* = *cisteloides*, Fröhl. (*castaneus*, Sturm).

— *ovatus*, Dej. = *agilis*, Erichs.

— *major*, Dej. = *picipes*, Erichs.

— *Americanus* was in too bad a state to determine.

— *morio* = *nigrita*, Erichs.

Under this name were found specimens of *nigrita*, *fuscus*, and *umbrinus*, but the preponderance in point of number was decidedly in favour of *nigrita*.

Catops tibialis, Dej. = *coracinus* ?, Kelln.

This species and a portion of those standing under the next name, *fuscus*, but which were the same, were marked as coming from Portugal. I thought they came nearer to *coracinus* than any other, but am not satisfied that they were not perhaps an undescribed species.

Catops fuscus = *tristis*, Erichs.

I have no doubt that Dejean meant *tristis* to be the type of his *fuscus*. He had a number of *tristis*, and one of

* Aubé in *loc. cit.*

grandicollis under it, and none of these under any other name. At the same time he had among them several of the above Portuguese species, and some of *alpinus*, Gyll., as well as *Spencianus*, Kirby (*cadaverinus*, Mann.).

Catops chrysomeloides = *chrysomeloides*, Sp.

— *australis* = *australis*, Erichs.

— *agilis* = *fumatus*, Erichs.

Some of *C. alpinus*, Gyll., were mixed with *fumatus* under this name, but the great majority were the latter.

Catops truncatus = *sericeus*, Erichs.

A single *fumatus* and a single *velox* have found their way into the mass of *sericeus*, but this is obviously by inadvertence.

Catops transverso-striatus = a new species described by me under this name in the foregoing pages.

Catops pallidus = *velox*, Spence. Represented by a single bad specimen.

Catops luridus = *scitulus*, Erichs.

The first specimens are *scitulus*, then follow some of *velox*, and lastly what may be *brunneus*, Sturm.

— *flavescens* = *præcox*, Erichs.

— *minutus* = *anisotomooides*, Spence.

The remainder of his species are different species of *Colon*, and do not fall within this Monograph.

I have only now to add the Dichotomous Table of the European species which I promised at the commencement of this paper. It is not to be understood as a substitute for the descriptions, but merely as a slight aid in turning to the quarter where the species are likely to be found.

Dichotomous Table of Characters of European Species of CATOPS.

1.	{ Antennæ nearly filiform and decidedly longer than thorax	1
		2
2.	Antennæ more or less clavate, and not longer or very slightly longer than thorax	5
	{ Thorax broader towards base than in front	<i>agilis.</i>
3.	Thorax not broader towards base than in front ...	3
	{ Punctuation coarse, pubescence long and sparse, and elytra bellied out	<i>spadiceus.</i>
	Punctuation fine, pubescence dense and short, and elytra elongate and narrow	4

4.	{ Margins of thorax paler than middle	<i>angustatus.</i>
	Margins of thorax not paler than middle ... <i>do.</i> var. <i>cisteloides.</i>	
5.	{ Base of thorax cut in, so as not to form a continuous outline with elytra	6
	Base of thorax forming a continuous outline with elytra or nearly so	19
6.	{ Colour of pubescence grey and brown or dull yellow on thorax, yellowish hairs on base and margins of elytra wanting or scarcely perceptible, and either no bloom or grey bloom on elytra	7
	Colour of pubescence clear yellow on thorax, a brownish-blue or purplish bloom on the elytra, and yellowish hairs on base and sides of elytra...	14
7.	{ Antennæ longish and subfiliform, not heavily clubbed	8
	Antennæ shorter and more clavate	12
8.	{ Elytra transversely strigose	<i>acicularis.</i>
	Elytra not transversely strigose	9
9.	{ Antennæ with apex pale	<i>picipes.</i>
	Antennæ with apex not paler than rest	10
10.	{ Posterior angles of thorax acuminate behind	11
	Posterior angles of thorax not acuminate behind ... <i>fuscus*</i> .	
11.	{ Posterior angles much produced, antennæ wholly ferruginous	<i>meridionalis.</i>
	Posterior angles only slightly produced, antennæ more dusky towards apex	<i>nigricans.</i>
12.	{ Antennæ very heavily clavate	<i>chrysomeloides.</i>
	Antennæ only moderately clavate	13
13.	{ Insect thin and narrow	<i>morio.</i>
	Insect shorter and more compact	<i>coracinus.</i>
14.	{ Antennæ comparatively long and subclavate	<i>nigrita.</i>
	Antennæ heavily clavate	15
15.	{ Thorax deeply punctured	<i>neglectus.</i>
	Thorax more or less transversely granulose or wrinkled	16
16.	{ Thorax nearly parallel on the sides	<i>quadraticollis.</i>
	Thorax not parallel on the sides	17
17.	{ Thorax faintly transversely wrinkled	18
	Thorax granulose	<i>tristis</i> , var. <i>rotundicollis.</i>
18.	{ Thorax short, transverse, and not broad; elytra usually very long	<i>tristis</i> (type).
	Thorax broad, elytra moderate in length ... <i>tristis</i> , var. <i>grandicollis.</i>	

* *Fuscus* is one of those species, which, from their transitional characters, nearly put dichotomy at defiance. It might almost be placed under No. 19 instead of No. 6, as the base of the thorax has only a slight interruption in its continuity; and again, its brown or purplish elytra are not unlikely to induce one to place it under No. 14 instead of No. 7.

19.	{ Middle tarsi widened in males	20
	{ Middle tarsi not widened in males	25
20.	{ Antennæ heavily clavate	21
	{ Antennæ subclavate	22
21.	{ Thorax not narrower at base than elytra	<i>fumatus</i> .
	{ Thorax slightly narrower at base than elytra	<i>alpinus</i> .
22.	{ Thorax with posterior angles rounded	<i>brevicollis</i> †.
	{ Thorax with posterior angles not rounded	23
23.	{ Thorax with lateral margins reflexly sinuated	<i>depressus</i> ‡.
	{ Thorax with lateral margins rounded	24
24.	{ Thorax with posterior angles projecting strongly backwards, forming an acute angle; elytra not distinguished by sericeous pubescence	<i>umbrinus</i> .
	{ Thorax with posterior angles projecting slightly backwards, the angle not acute but right-angled; elytra distinguished by a silky pubescence which in different lights shows like a light band across them	<i>scitulus</i> .
25.	{ Thorax not wider at base than elytra	26
	{ Thorax slightly wider at base than elytra	<i>præcox</i> .
26.	{ Elytra more than three times the length of thorax	<i>transverso-striatus</i> .
	{ Elytra not more than three times the length of thorax	27
27.	{ Basal margin of thorax sinuated	<i>velox</i> .
	{ Basal margin of thorax straight	28
28.	{ Posterior angles of thorax right-angled	<i>badius</i> *.
	{ Posterior angles of thorax obtuse	29
29.	{ Insect roundish	<i>anisotomoides</i> .
	{ Insect more elongate	<i>brunneus</i> *.
30.	{ Body polished and shining	<i>lucidus</i> .
	{ Body not polished	31
31.	{ Elytra not truncate	32
	{ Elytra truncate	33
32.	{ Elytra acuminate	<i>strigosus</i> .
	{ Elytra not acuminate	<i>Colon</i> .
33.	{ Antennæ with apical joint pale	<i>varicornis</i> .
	{ Antennæ with apical joint not pale	34
34.	{ Antennæ heavily clubbed, with base not paler than rest	<i>validus</i> .
	{ Antennæ moderately clubbed, and base paler than club	<i>sericeus</i> .

† Not having seen this species, I only place it under No. 19 provisionally, the description given by M. Kraatz being scarcely sufficient to satisfy me as to its place.

‡ Not having seen the male of this species, it is only from supposition that I have placed it under No. 20.

* Not having seen *badius* nor *brunneus*, their place is marked provisionally and with hesitation.

3. *On Gemmiparous Reproduction (multiplication) in Actinia dianthus.*
By THOMAS WRIGHT, M.D. (Living specimens were exhibited.)

The author stated that *Actinia dianthus*, the Plumose Sea Anemone of Dalyell, was found on the shores of the Firth of Forth, generally on rocks which were uncovered by the sea only at very low tides. Its habitat was not extensive; it is gregarious, great numbers being frequently found in a very limited space. At Arran he had seen several hundreds closely aggregated together, clothing the roof of a wide low cave, and hanging down like so many membranous bags half filled with water. A similar colony had existed on the perpendicular surface of a single large stone opposite to the Baths at Seafield; and, again, another on the under surface of a large overhanging rock at Wardie. It had been a matter of question with the author, how the young of these Actinias, if ejected from the mouth, as in *Actinia mesembryanthemum*, *troglodytes*, *bellis*, and *gemmaea*, were able to attach themselves to the rocks, instead of falling down and being washed away by the tide. It was known that *Actinia mesembryanthemum*, *troglodytes*, and *bellis*, were exceedingly prolific, Sir John Dalyell and Dr Cobbold having seen twenty or thirty produced at a single litter from the first species, and yet the number of very young Actinias found in situations where old specimens abounded was very small, and certainly bore no proportion to the number generated. The cave at Arran was very difficult of access, on account of its shallowness and the floor being covered by a pool of water; and the Actinias were only to be reached by assuming a posture which could not be maintained for more than a few minutes. A number were, however, obtained, which, being attached to sponges, were easily stripped from the rock, and with them were associated a great number of very small specimens. Not long afterwards, the author noticed a number of young surrounding a large white *dianthus* in the Vivarium of a friend at Leith, and was told that the Actinia, while moving round the tank, had left behind it small white bodies, which separated themselves from the foot or sucker and became young Actinias. Sir John Dalyell had described a similar mode of multiplication in *Actinia lacerata*, and Hollard in *Actinia rosea* (?) The former writer had observed that *Actinia lacerata* protruded from all parts of its foot, stolons or suckers, which became detached, and presently put forth tentacles, and were developed into minute Actinias. After reading Sir John Dalyell's account of *Actinia lacerata*, Dr Wright was anxious to ascertain whether there might not be included in the prolongations separated from the foot, either true ova or germs, or some tissue specialized for the production of young. In the hydroid zoophytes, such as *Hydra*, *Coryne*, &c., the walls of the body consisted of three elements or layers,—a dermal or integumental, an areolar or muscular, and a mucous or intestinal layer; and when gemmation took place in these animals, it occurred by the protrusion of a simple diverticulum

or sac from the canal of the body, formed of all the three elements. This diverticulum was developed into a polype body, with mouth and tentacles like those of the polype, from which it pullulated ; the two bodies having the digestive canal and all the tissues continuous with each other. In *Hydra tuba*, multiplication took place by stolons, which extended to some distance from the body before the new polype bodies sprouted from them, but in that case also a prolongation of the intestinal element passed through the stolon from the old into the new body. These new polypes were not young ; their production was a simple increase of the individual, becoming afterwards a multiplication, either by accident, in some cases, or in others by a natural process of absorption. The structure of the helianthoid zoophytes or *Actinias* was more complicated in its development than that of the hydroid polypi, but it consists of the same three elements. The dermal coat was succeeded by the muscular element, which constituted the chief part of the external wall of the body and tentacles, and then passed inward to the stomach, in the form of septa or partitions, which suspended that viscous in the centre of the body, and divided the intervening spaces into numerous chambers. The mucous or intestinal element existed as a flattened sac or stomach, which appeared, when viewed edgewise, as a mere line extending down about half the centre of the body. The stomach communicated freely with the general cavity of the body. This cavity, which corresponded to the water-vascular system of the *Acalephæ*, was single below, but as it passed upward it formed a number of chambers divided from each other by the septa before mentioned, and finally communicated with the tentacles, each chamber terminating in the cavity of a single tentacle.

The whole of the general cavity and its chambers was lined with cilia, by which a constant circulation of the fluid was sustained, and the functions of nutrition, respiration, and excretion were all carried on simultaneously. From the lining membrane of the general cavity, the male and female reproductive organs were also developed, and there, in some species, the ova were hatched, and the young (at first mere shapeless, ciliated germs, swimming rapidly in the fluids of the cavity, chambers, and tentacles) became fully formed, passed into the stomach of the parent, and were ejected from the mouth as perfect *Actinias*, with mouth, tentacles, and suctorial foot. The author had thought it possible that the prolongations from the foot of *Actinia lacerata* might contain one of these hatched germs in its imperfect state, and that it might be thus deposited on the surface occupied by the parent, and its safety insured. Having some specimens of *dianthus* in his possession, he had waited for some time in vain for their multiplication by fissure ; he therefore determined to try an *experimentum crucis*, and for that purpose having placed the specimen in a jar of sea-water, and fed it until it had become fully distended, he examined the edge of the foot, which was perfectly transparent, with a powerful lens, and convinced himself that no ovum or germ existed in that situation. He then separated a piece about a line in length, by half

a line in breadth, from the edge of the foot. The parts immediately receded from each other, and the next day he found that the separated portion had crept to a considerable distance along the glass. In two or three days it had raised its divided edge from the surface to which it was attached, and had become a curved column; in a fortnight tentacles had appeared; and in three weeks it had become a perfect *Actinia*, with a single row of beautiful long tentacles. From the foot of this small *Actinia* he cut two other exceedingly minute slips, which also became *Actinias*; and from the foot of the original *Actinia* he also separated, at various times, fourteen other slips, all of which became developed as the first. The author stated that this case of gemmiparous increase was an instance of the development of a perfect and very complicated organism, from a minute fragment of one similar to itself, all that was essential to the process being apparently the existence of a portion of each of the three elemental tissues of the original, the dermal, the muscular, and the mucous tissue,—the last being represented by the lining membrane of the general cavity. And it appeared to be analogous to the instance of gemmation from the water-vascular system observed by the late Professor Edward Forbes in *Sarsia prolifera*, in which animal the young medusæ pullulated forth from the hollow bulbs which supported the tentacles.

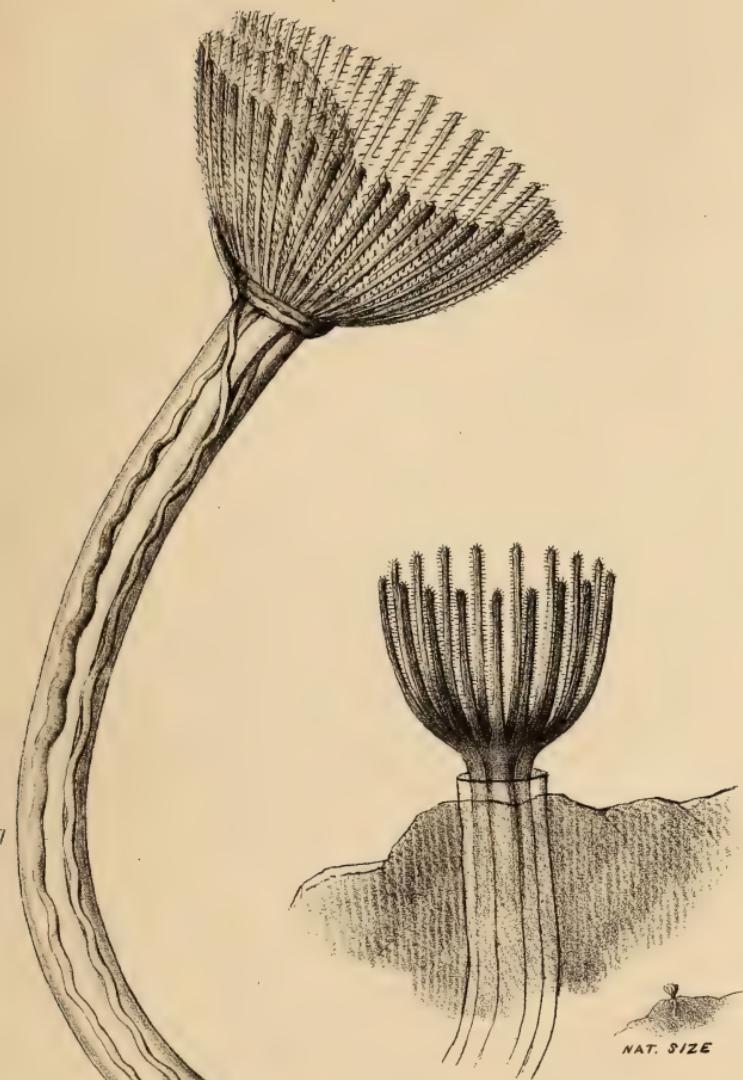
4. *Memorandum of Shells and a Deer's Horn found in a cutting of the Forth and Clyde Junction Railway, Dumbartonshire.* By JAMES M'FARLANE of Balwill, Esq., W.S. (Specimens exhibited.) Communicated by JOHN ALEX. SMITH, M.D.

“The locality in which the horn, shells, and fragments now on the table were found, is situated in the county of Dumbarton, parish of Kilmarnock, in the basin of the Endrick, which flows into Loch Lomond, and at a distance of nearly a mile from that river, and about four miles from the nearest part of Loch Lomond, immediately adjoining the hamlet of Croft-amie. They were exposed by the excavations connected with the formation of the Forth and Clyde Junction Railway. The ground in the neighbourhood is of an undulating character, and, as will be seen by the map and section exhibited, the shells were found under one of the ridges, and at a depth of 21 feet from the surface. The horn was found within a few yards of where the shells were lying, at a depth of 18 feet. The superincumbent mass consists of a stiff till about 12 feet thick containing a large quantity of stones, some of a round form, apparently water-worn, others angular, and many of them of a great size. Under the till is a bed of blue clay about seven feet thick, and under this, and resting on the freestone, or very close to it, the horn and shells were lying. The small round stone was found embedded in the clay, and was the only one of the kind seen. The following table may not be uninteresting as connected with the above:—

Height of Loch Lomond above sea,	23 Feet.
,, of Endrick above do. one mile from spot indicated, and	
where shells and horn found,	30 ,
,, of the surface of ground above sea as taken from rail-	
way plans,	121 ,

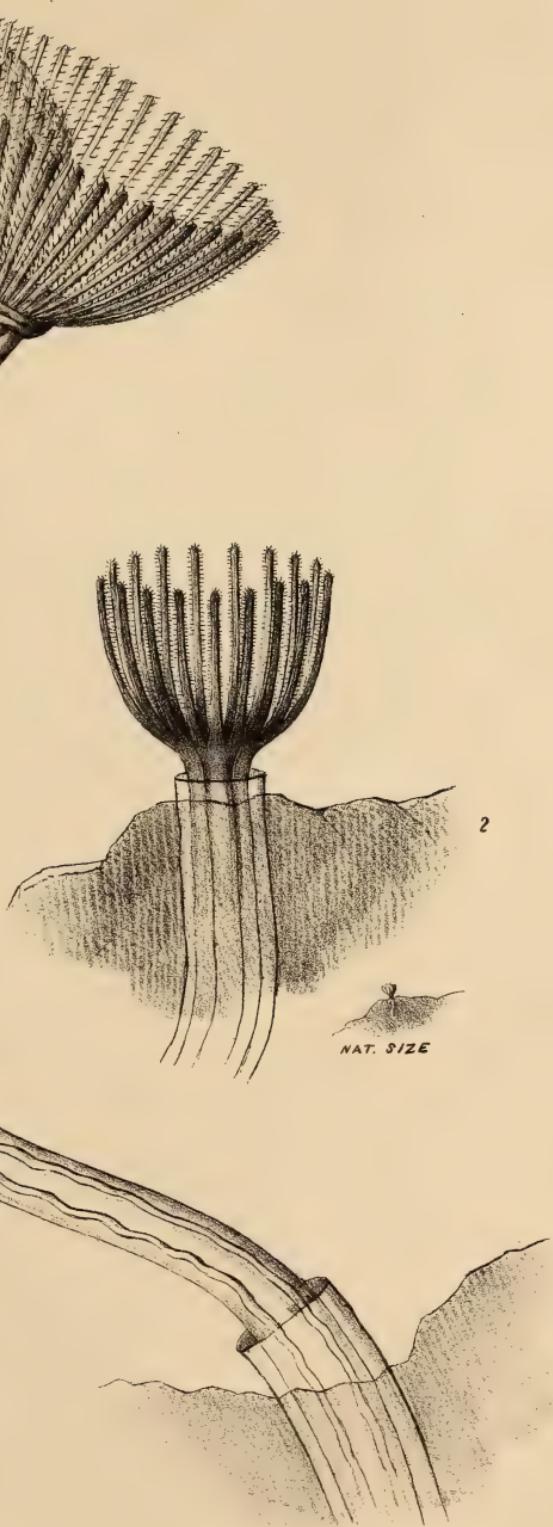
So that, as near as can be calculated, the articles lay from 100 to 103 feet above the level of the sea."

Dr John Alexander Smith said, the marine shells found at Croftamie now exhibited, consisted, he believed, of the following species:—*Cyprina islandica*, *Astarte eliptica*, and *A. compressa*, *Fusus antiquus*, *Littorina littorea*, our common whelk or periwinkle, and the shelly base of a species of *Balanus*, adherent to a small stone. Other shells were seen in the railway cutting, but these were all that had been preserved; and they are all shells at present inhabiting our Scottish seas. The small stone alluded to was of limestone. The horn might be supposed to belong to the red-deer *Cervus elaphus*; but from its smoothness and compressed character he was inclined to believe it to be that of the reindeer, *Cervus tarandus*, remains of which had been described by Dr Scouler as having been found in the valley of the Clyde. The smoothness of the horn, should it still be considered that of a red-deer, might, perhaps, be supposed to be accounted for by its having rolled for some time among the stones and sand of a sea-shore. The comparatively high position in which these marine remains were found was exceedingly interesting, as there could be no doubt of the correctness of the respective measurements above the sea-level given in Mr M'Farlane's exact and minutely detailed communication. In the "Memoirs of the Wernerian Society" for 1822, Mr Adamson describes several marine deposits on the margin of Loch Lomond; one of these was about eight or ten feet above the highest level of the present waters of the loch, and about two miles N.W. of the mouth of the Endrick. And in two other localities—one on the island of Inch Lonach, opposite the village of Luss; and the other on the lands of H. M'D. Buchanan, Esq., near the south-east angle of the loch; the shells (corresponding in character to those exhibited) begin to appear between the highest and lowest, or winter and summer, surfaces of the loch. They are found in a bed of brown clay under a slight covering of coarse gravel; and Mr Adamson considered these deposits could not be more than about 22 feet above the present sea-level. Here, then, we have, in the first place, a series of marine deposits, at or a very little above the present level of Loch Lomond, pointing to a very different state of matters, when Loch Lomond existed as an arm of the sea, with its marine inhabitants; giving us an elevation now of about 22 or 23 feet above the present sea-level,—and, secondly, the marine deposit in the valley of the Endrick, a few spoils of which are before us, found at an elevation of 100 or 103 feet above the present level of the sea. On referring to Mr Robert Chambers's work on "Ancient Sea Margins," he found in the Appendix references to various terraces as existing both in the Firth of Forth and in the Firth



1. *Phoronis Hippocrepia*

T. STRETHILL WRIGHT, DEL.



2. *Phoronis ovalis*

F. H. WEISSE LITH.

W. H. LIZARS IMP.

of Clyde and Leven Vale; of these, one ranges from 26 or 27 to 32 feet; and another at 96 to 117 feet above the present sea-level; these nearly corresponded to the sites of the marine deposits he had described, and show at least an interesting coincidence of level. He had no intention at present of opening up the debateable questions connected with the theory of raised sea beaches, or the powers of tremendous floods or other agencies in carrying marine debris to unusual elevations; but considered Mr M'Farlane's memorandum well worth recording as a contribution to the facts of this disputed case.

Wednesday, 23d April 1856. W. H. LOWE, M.D., Pres., in the Chair.

The following additions to the library were laid on the table, and thanks voted for the donation:—

1. *Memorias de la Real Academia de Ciencias de Madrid.*—Tomo I. Parte 3. *Ciencias Naturales.*—Tomo II. Parte 1. *Ciencias Exactas.*
2. *Resumen de las Actas de la Real Academia de Ciencias de Madrid.* 1851-52, and 1852-3.

From the Royal Academy of Sciences of Madrid.

1. *Description of two Tubicolar Animals.* By T. STRETHILL WRIGHT, M.D., F.R.C.P.E. (With a Plate.)

In February last I received a number of *Caryophilliæ* from Ilfracombe, and, on examining one of these, I found three specimens of an animal, which I am led to believe is undescribed, inhabiting the stone to which the Lithophyte was attached.

The body of the largest specimen (see Plate, fig. 1), when fully extended, consisted of a hollow tube or tunic about $\frac{1}{10}$ ths of an inch in length by $\frac{1}{100}$ th of an inch in diameter, smooth, and bearing no trace of annulose structure. Its summit was crowned by an expansion of sixty undivided tentacles, similar to those of a Polyzoan mollusc, and clothed with cilia, the motion of which presented the usual appearance of teeth moving in opposite directions on opposite sides of the tentacles. The tentacles were united at their base by a thick membrane, and were arranged in a crescent as in Polyzoa of the Hippocrepian type. The concavity of the crescent dipped downwards, and consisted of shorter tentacles, as in *Plumatella*.

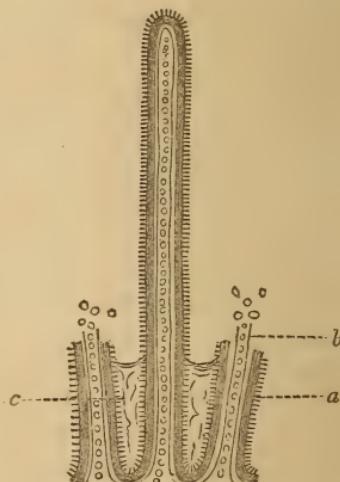
The animal inhabited a transparent tube or cell of membranous texture, the mouth only of which could be detected, as the rest of the tube was deeply buried in the stone. Although it was frequently found extended in a remarkable degree from its cell, the slightest shock caused it to retract itself and disappear with a quick jerk within its retreat. As its posterior extremity, therefore, was never visible, it was only possible to examine part of its anatomical structure. This consisted of the alimentary system, the vascular system, the muscular system, and the integument.

The *alimentary system* consisted, as in *Plumatella*, of a mouth placed within the tentacular cup, and closed by a semilunar lip or valve. The mouth opened into a long tube or gullet, which passed down the axis of the body and disappeared within the cell of the animal. The alimentary canal probably communicated there with a stomach, and then returned upwards to the mouth of the cell, where it again became visible as a thin membranous tube passing up the body, and terminating, as in *Plumatella*, in an anal orifice, situated immediately beneath the tentacular crown on its concave aspect. The mouth was generally in constant motion; and when the animal was undisturbed, ciliary action and the passage of nutritive matter were detected within the interior of the gullet, while the ejection of the peculiar fusiform fæces, which formed so striking a feature in the economy of *Plumatella*, was frequently observed to take place from the anal orifice.

The *vascular system* consisted, as far as could be seen, of an artery which passed up the axis of the body, in close connection with the gullet, until it arrived at the tentacular cup on its concave side; it there divided at right angles into two branches, which passed within and around the tentacular cup, and sent a capillary twig into each of the tentacles. These capillaries had distinctly contractile walls, and were loosely attached by cellular tissue to one side only of the cavity of the tentacle. (See woodcut.)

The artery pulsated rather irregularly at the rate of about fifteen beats in the minute, and at each pulsation a wave of red blood (red blood globules floating in a pale *liquor sanguinis*) passed, like a railway train, along the artery and its branches up into the very end of the hollow tentacles. The blood, after momentarily resting in the capillaries of the tentacles, was ejected from them by an undulating contraction of the walls of those vessels, and returned in a regularly-flowing stream along the venous system. The venous system was first detected as four branches, viz., one from the outside, and another from the inside, of each of the horns of the crescentic tentacular cup. The two branches on each side immediately united, and the two vessels thus formed encircled the gullet, and united to constitute a single vein, which traversed the axis of the body on the side of the gullet opposite to that occupied by the artery.

I have stated that the blood, urged by the contractile artery, passed at once into the interior of the tentacles, and sometimes such appeared to be the case: but it frequently happened that the globules were observed ascending some of the tentacles at the same time that they were descending



a, wall of tentacle; *b*, capillary containing blood-globules; *c*, membrane uniting tentacles.

others in their immediate vicinity. Hence I think we must suppose some auxiliary propelling apparatus to be interposed between the artery and the tentacular capillaries. The opacity of the cup, from which the tentacles spring, not only prevented me from detecting any such arrangement, but also from observing the mode of communication between the capillaries and the venous system. The *muscular system* consisted of a layer of flat longitudinal bands immediately beneath the integument, and interior to these fine circular fibres could be traced with extreme difficulty under a power of 300 diameters. The viscera were retained in their place by delicate areolar fibres.

The second animal I have to describe, and which is probably another species of the last, was found in a decayed oyster shell dredged from the Firth of Forth near Inchkeith. The shell was inhabited by *Clione celata*, and while examining the projecting processes of the sponge, I noticed a great number of animals which I for some time mistook for *Lepralia*, until my attention was arrested by a slight want of symmetry in the circle of the tentacles. It was not a circle, but rather an oval very slightly flattened on one side. A power of 200 diameters was brought to bear on one of the animals, and it appeared as shown in fig. 2. The body, slightly projecting from a membranous tube buried in the shell, carried a crown of eighteen tentacles finely ciliated, but not presenting the appearance of moving teeth. They were not connected by membrane at their base. Within the tentacles, a constant stream of blood-globules ascended and descended precisely as in the animal before described in this communication, but the opacity of the cup prevented the detection of any larger vessels. I succeeded in digging only one of these animals with its tube entire from the shell. It was about half an inch in length. The long gullet terminated in a globular gizzard, the interior of which was paved with bodies apparently cartilaginous, and of prismatic shape. The gizzard communicated below with a thick walled stomach. No ascending rectum was detected; but I inferred it to exist, hidden behind the stomach, as a thin membranous tube containing fusiform faeces was observed passing upwards to the tentacular crown. The blood-vessels were displaced, and lying twisted together within the body.

These animals have been examined by the most eminent naturalists in this city, who consider that they possess great interest. They appear to me to possess characters common to the Polyzoa (*Plumatella*, *Pedicellina*), the Tunicata (in which the circulation of red blood has been noticed by Milne-Edwards), and the Annelida, in which last class they probably ought to take their place. I propose to designate the first of these animals *Phoronis* hippocrepia*, the second *Phoronis ovalis*.

* PHORONIS, one of the surnames of Isis.

2. *Note on Indications of the Existence of Bilateral Symmetry, and of a Longitudinal Axis in Actinia, as shown in Living Specimens.*
By T. STRETHILL WRIGHT, M.D.

The author stated, that he had lately received from the south of England several specimens of *Actinia bellis*, which illustrated in a striking manner the existence of bilateral symmetry and of a longitudinal axis, maintained by Agassiz as occurring in this and other classes of the Radiata. The members of the Society would at once perceive that the disks of the animals placed on the table were not circular, but oval; and that the slit of the mouth intersected the long diameter of the oval. Agassiz had noticed that the faecal discharge in *Actinia* always took place from one extremity of the mouth, which was indicated by a tentacle of peculiar colour or form. This observation had been confirmed by Dr M'Bain of Leith. In some of the specimens exhibited, the faecal extremity of the mouth was marked by a brilliant yellow tentacle, while all the other tentacles were of the usual mottled-brown colour. Others of these specimens, again, exhibited still more remarkable markings. At first sight, their disks appeared to be accurately divided into four quarters, three of which were striped with broad lines of white, whilst the fourth was of an unmixed brown colour. A closer inspection showed that this fourth was intersected by the line of the mouth and the long diameter of the oval, so that in these specimens the bilateral symmetry was perfect, and the existence of an antero-posterior diameter very apparent.

3. *Specimens of living Madrepores (Caryophyllia Smithii), from Ilfracombe, Devonshire, were exhibited.* By T. STRETHILL WRIGHT, M.D.

4. *A Collection of Scales of the Holoptichius maximus was exhibited; found on Rule Water, Roxburghshire.* By JOHN ALEX. SMITH, M.D.

The specimens consisted of single scales, apparently of the *Holoptichius maximus*, part of a cranial plate, and what appeared to be part of a fin-spine. They were found in the red sandstone rock, on the property of Wolflee, at the head of Rule Water, Roxburghshire, where a small quarry had been opened for building purposes, which Dr Smith visited last summer. He made some remarks on the sandstone formation of the district, and referred to the previous view entertained of its geological position, stating that Mr Alexander Rose had many years ago discovered a scale of the *Holoptichius*, and satisfied himself as to the formation being really the old red sandstone; Dr Smith said, from the abundance of scales, although generally in bad preservation, to be found, he believed, all along the river Rule, it was rather astonishing its true position had been so long considered doubtful.

Committees were appointed for conducting investigations during the summer, and the Society adjourned to November next.

Postscript to Communication on *Cydippe pomiformis*.On the existence of Thread-Cells on the Tentacles of *Cydippe*.

By T. STRETHILL WRIGHT, M.D., &c.

In my description of the tentacles of *Cydippe* (see page 63), I stated that their surfaces were crowded with minute thread-cells. I was therefore surprised to find it remarked by Professor Huxley (*Medical Times and Gazette*, June 21, 1856), that true thread-cells had not been observed in the Beroida, to which class *Cydippe* belongs. At that time the Firth of Forth was swarming with a small variety of *Cydippe*, distinguished by the rufous colour which tinged the bases of the tentacular cirri. The amputated tentacles of this species adhered with extreme tenacity to bodies applied to them. When examined under a power of 300 diameters, they were seen to be so closely studded with small cells, that their surface had a granular appearance. These cells were spherical, and opaque from the presence of molecular matter in their interior. When ruptured by pressure, they were found to contain a simple short thread, more or less closely coiled in a spiral form. The application of distilled water burst the cell-walls and uncoiled the threads. In the annexed sketch I have shown at 1, the thread-cells burst by pressure; at 2, the molecular matter evacuated from the cells, which is in constant motion; at 3, the threads uncoiled by distilled water.



PROCEEDINGS
OF THE
ROYAL PHYSICAL SOCIETY.

EIGHTY-SIXTH SESSION, 1856-1857.

Wednesday, November 26, 1856. ROBERT CHAMBERS, Esq., President,
in the Chair.

The following Donations to the Library were laid on the table, and
thanks voted to the donors :—

1. Army Meteorological Register, from 1843 to 1854, inclusive. Pre-
pared under the direction of Surgeon-General Thomas Lawson, United
States Army. Presented from the American Government through the
British Foreign Office.—2. Proceedings of the Berwickshire Naturalists'
Club, 1856. From the Club.

I. ROBERT CHAMBERS, Esq., then delivered the Opening Address as
follows :—

GENTLEMEN,—We are now commencing the eighth year of
what I may call the revived or second life of the Royal Phy-
sical Society. I am happy to be able to congratulate the
members on the prospect of its living many more years in use-
fulness and honour. Its activity is undiminished; its meet-
ings, by the amount of attendance, show that a general interest
in our objects is sustained; perfect harmony prevails amongst
us; and our proceedings begin to make a respectable appear-
ance in the current annals of science. At the same time there
is a constant addition of new members going on, and our
Treasurer's accounts show that our funds are in a sufficiently
flourishing condition.

While congratulating ourselves on the number of our mem-
bers, I would have you all keep in mind the necessity of every
effort being made to obtain new ones. We are the more under
this necessity from the sad fact that every year is removing
some of our number, and these sometimes the most valuable

Since our last season, death has deprived us of an active and useful member in Mr J. Barlow, of the Edinburgh Veterinary College, and of a distinguished one in Mr James Wilson. On the long-continued, diligent researches of the latter—his many excellent writings on insects, birds, and other branches of zoology—and his universally appreciated personal character, I could here enlarge; but it would only be to remind you of what you all know and feel, and have probably been expressing repeatedly since his lamented death.

I think it may now be held as demonstrated, that, whatever may be the case with other scientific societies in Edinburgh, there is a place and a function for the Physical. It is perfectly evident that a number of gentlemen engaged in the study of Natural Philosophy, and a still greater number devoted to the various departments of Natural History, have found here a convenient point of rendezvous, where they might review, in the light of each other's judgment, the facts and results they had arrived at, and obtain that serviceable encouragement in their pursuits which is naturally to be derived from association. It is not in the least necessary to consider this Society as the rival of any other, or as weakening any other. Its range of objects is indeed the same as that of the Royal Society of Edinburgh, regarded in its scientific as apart from its literary department. But I contemplate this Society as more calculated to feed and strengthen the Royal Society than to do it harm. There is another Society of respectable name, to which I can scarcely forbear making allusion on the present occasion, as a proposal to it to unite with our own has recently been under consideration. It is perfectly clear that to the Wernerian we can do no kind of damage, if it be true, as I am informed, that it has had no meetings for several years. As the Physical, however, has in the interval come to serve the purpose which the Wernerian formerly served, of being a rallying point for the pursuit of Natural History in Edinburgh, we may well fear that some injury would accrue to us, if the Wernerian were again in activity. For this reason, and as the union of funds, library, &c., would be mutually advantageous, I would hope that ere long the two bodies may be resolved into one. It has been suggested that the Physical,

Wernerian, and Botanical, might form a *Natural History Institute* for Edinburgh, with three departments, namely, zoological, geological, and phytological. But three sets of meetings are far beyond what experience has shown that Edinburgh can support; and if I might be permitted to express an opinion, I would strongly counsel that the Physical and Wernerian form at the most one body with one set of meetings. And with all due respect to the philosopher of Freyburg, I clearly opine that it is time to drop his name when the theory associated with it is so completely extinct; therefore, I would say, let the two bodies henceforth appear under the title of the ROYAL PHYSICAL SOCIETY.

There is one feature of the practice of this Society which I am inclined to notice on the present occasion, as affording a recommendation to young men to connect themselves with it. This is the conversational nature of our proceedings. Seated, as we usually are, around a board containing specimens and instruments, and in close proximity to our President, every one has a ready opportunity of examining whatever may be brought forward, putting questions about it, and receiving explanations. Aspirants are thus encouraged to state their difficulties, and to ask for information. Young and old members, graduates of last session and veteran professors who began to gather fame half a century ago, come into familiar contact, and learn to like and respect each other. Conscious ignorance and inexperience are not abashed here, but rather encouraged to reveal themselves, that they may go away instructed. Of course, in our conversations, it is not to be expected that we are to take harmonious views on every point. But when differences are stated with good temper, and under restraint of the rules of civility, as they are here, we do not find that they have a bad effect in any respect. On the contrary, they tend to advance truth, as well as to check vanity and dogmatism. I must, then, express my hope that this conversational character of our meetings may be persisted in, and maintained in full force, as it has heretofore been.

Having spoken of conscious ignorance and inexperience, I am induced to make a general remark thereupon, in the hope that it may benefit some who hear me. It is simply to the

effect that I should wish to see all who come here acting with perfect frankness as to what they know and what they do not know. When we hear a member speaking of anything beyond our range of knowledge, but which we think we might master if it were explained to us, why should we let it tacitly pass, as if it were a matter already familiar to us? Undoubtedly, if we do so, we shall lose the opportunity of learning something on that subject, besides being guilty of a kind of hypocrisy. Why should we not rather candidly confess our ignorance on the point in question, and desire to have it fully explained to us? Does it jar upon our self-esteem to profess ignorance on any point? Surely that is absurd, when we reflect how vast is the circle of the known and knowable,—how finite is the power and opportunity of study. If it were to be reasonably expected of us that we should know everything, then to be ignorant of anything would be truly a disgrace. But as no such thing is reasonably to be expected, ignorance on any one subject can be no discredit. Even the man who has some name in science, when I hear surprise expressed that he should be uninformed on some subject which has arisen, so far from deriding, I am rather disposed to honour him. He has two merits in the case,—one from his candour, the other from his desire to learn. If it be said, "But he is one who sets himself forth as a scientific man; something else is to be expected of him,"—I answer, "Why assume that he sets himself forth as a scientific man? He has endeavoured to learn something of science, and we recognise his name in connection with scientific societies, perhaps even in connection with scientific papers and treatises. But while he may have made some way in certain paths of knowledge, it is certain that he cannot have acquainted himself with all. To find him, then, presenting himself as still a learner in certain matters, is no way irreconcileable with his character as a scientific man. Let us give him credit for what he knows, and only admire him for so frankly showing that he has still something to acquire." I hope that the Physical Society will long remain as a place where we can mutually enlighten each other's ignorances—where we shall be equally glad to gather some fresh information, and to impart what we possess. Bear with me in a little egotism, when I

tell you that I consider myself here chiefly in the capacity of a learner. I come here because I love science, and, from sympathy, like to be among its cultivators; also with the view of communicating any novelty in nature that may occur to my observation; but even in a greater degree, because I feel myself to be but slightly informed on most subjects, and wish to be more largely and more accurately informed on all.

Upon the spirit in which men come to and work in a scientific society, will manifestly depend, in a great measure, its success. May I be permitted to remark, that if men come to it with views confined to the gratification of their self-love, seeking praise for every little labour they perform, jealous of the merits of their fellow-labourers, eager to advance favourite dogmas, and consequently intolerant of the convictions of others, they will act as impediments to its success? It seems to me that the spirit that ought to guide us in our capacity as members of a scientific body is one the very contrary of all this. Here, almost as much as in the temple itself, the self-hood and all its concerns ought to be set aside. Our proper purpose being to study the natural system of the universe, and ultimately, as I hope is the case with most, the God who is the author of that system, and whose will it expresses, we should enter the hall of science with, as far as possible, pure hearts, glad for the time to leave all worldly and arrogant feelings behind us, and thinking only of how we may increase the number and the lustre of those truths on which the welfare of God's creatures so much depends. If so we approach this table, I think we shall find a true and lasting, instead of a false and unsatisfactory, reward. We shall, in the first place, delight to feel that there is one spot in this world's waste where its heart-sickening warfare is stilled,—one hour in the day or the week during which we do not need to look on our fellow-man as a rival and an enemy. We shall, in the second place, have the permanent happiness of reflecting that we have not given our whole life to the support of its daily and material needs, but done some little thing in our time to perfect the illustration of our Master's works and his praise.

On the motion of Professor FLEMING, a vote of thanks was unanimously given to Mr Chambers for his address.

II. *On the Structure and Habits of the Slow-Worm (Anguis fragilis, Linn.)* By DANIEL R. RANKIN, Esq., Carluke.

From what is recorded in works of reference, the slow-worm (*Anguis fragilis*), though the most accessible and easily managed of the reptile kind, seems to have engaged the particular attention of few naturalists.

During several years, from daily observation of many individuals of uncertain age, and in every stage of development, from the egg till the seventh year, having accumulated a considerable number of facts regarding the economy of this interesting little animal, I am enabled to give some details which may serve more fully to elucidate its history.

The generic position of the slow-worm is well determined; but as general descriptions seem to have been drawn from limited sources, from young or mutilated specimens, or from individuals in some phase of periodic change, confusion appears to exist; and in other particulars there is uncertainty or error.

To secure clear and distinct delineations of objects in Natural History words are seldom adequate; but as the aspects of this animal, within description, may be better given if spoken of under divisions, that method shall be followed.

1. *Form.*—The mature animal, as it is found in Clydesdale, is from 17 to 20 inches in length, and attains to this about the fourth, although its other dimensions are not fully reached till about the seventh or eighth year. It has a small, elongated, somewhat angular and conical head; mouth of almost equal length with the head; eyes lateral, oval, distinct, though not prominent; ruby iris; eyelids, and a moveable membrane within eyelids (*membrana nictitans*); nostrils lateral, directed vertically, and situated in the second scale of the second row of the marginal labial scales of the upper jaw, the scale being reflected into the aperture. The neck is short, and at times is observably smaller than the head, as in the act of inspiring, drinking, &c. The body, from the neck, gradually swells to the middle, then gradually declines in thickness to the cloaca, and from thence becomes smaller and smaller to the extremity of the tail, which ends a little short of a minute point. A specimen before me, a female fourteen

years old, measures 14 lines ($\frac{1}{2}$ of an inch) round the largest part of the head; at the middle of the body, or about 4 inches from the head, it measures 25 lines, and above the extreme point of the tail it measures 5 lines. The head is $\frac{1}{6}$ part of the whole length—the body, including the head, being about 8, and the tail about 9 inches. These proportions produce a form by no means repulsive, if the word elegant is objectionable as regards a crawling thing. The animal is not, therefore, “alike thick from neck to tail;” nor does the tail “end quite bluntly,” according to stereotyped descriptions. Young animals of the same, or of greater length, are more slender; those, for example, of the first year are from 13 to 14 inches long, although so slender as to bear the proportions of a large earth-worm, the head and body being of nearly equal diameter, and the tapering tail slightly smaller. A specimen of the fourth year, still of slender proportions, measures $17\frac{3}{4}$ inches, and one of the seventh year bears nearly the same proportions as the more aged animal before alluded to. After the first year the growth is more to thickness, in proportion, than to length. When observed carefully, the body seems somewhat four-sided, and not strictly round—an aspect which the colours of the different quarters tends to favour.

2. *Colour and External Markings.*—The upper part (back) of the head and body, in the mature animal, to the extent of about a fourth of the diameter, is generally of a lustrous yellowish-brown marbling; each side to the extent of one-fourth is of a blackish chequered gray, in some instances more intensely dark than in others, excepting on the sides of the head and neck, which is a kind of mottling of lighter colour on a dark ground, the remaining fourth, or belly, being of a bluish-gray. In passing from the back to the head, there is a narrowing of the lustrous part, which again swells out anteriorly. Two black spots mark the head—one commonly on each of the larger vertical scales—and in the posterior spot there is an opaque whitish point corresponding with a small opening in the skull. A black zig-zag line passes down the back, dividing equally the bright yellowish-brown part from the posterior central scale of the head to the point of the tail. In some instances this line is more of a dovetailing character;

in others, there are parallel lines or dots, giving the appearance of three, five, and seven lines in different specimens, and in many the centre line is entirely absent. Among eighteen specimens examined at the time of writing, seven only presented the single central line down the back, which, nevertheless, is the prevailing form. In the young, on leaving the egg, and for some time after, the colour of the back is generally hazy yellow, with, in most instances, a straight black line down the back, while the under three-fourths is glossy black. But from the first there are distinct and numerous varieties of external markings. In an animal, under observation, three years old, the characteristic centre line is wanting; but the yellowish-coloured part of the back is traversed by several faint dark interrupted stripes, and on each side the scales of the fore part of the body are beautifully marked with spots, each of which consists of a dot of green and a dot of black. In another, sixteen months old, also without the centre line, interrupted dark spots pass down the body, and the scales of the tail are each marked by sometimes two, and sometimes three dark streaks, which give the tail a striped appearance. In another specimen, two years old, there are not only three black lines down the back, but between each, two others less dark; and these do not by any means comprise all the varieties of external markings.

But difference of age, or exceptional markings, do not sufficiently compass the aspects of the animal, for the approach of the sloughing periods, which are frequent, very materially alters the appearance alike of the young and old.

3. *Dermal Covering and Sloughing.*—The common notion that a serpent “casts its old skin” once in the year does not hold good as regards the slow-worm, though this is stated by most popular writers. The dermal covering of this animal, unlike that of serpents, but like some other reptiles and fishes, is a beautifully arranged system of plates of bone, on which the scales or cuticle repose. These, what I shall call scale-plates, are permanent, and grow with the animal; the scales, on the contrary, are frequently renewed, particularly during the growth of the animal. A specimen, in its eighth year, fed regularly throughout the whole period while its own dormancy

allowed, and while slugs or worms could be procured, sloughed ten times, and in the following year nine times; and this seems, from a large average, to be a common result. In three years, one young animal sloughed thirty-four times, and another thirty times. In the first year of rapid growth, one sloughed thirteen, and other three twelve times.

The following table gives the exact dates of sloughing of four specimens hatched 3d September 1845, which were easily distinguished, and known by the names heading the table:—

Sloughs.	Spotty.	Spotless.	Spot.	Mag.	Sloughs.
	1845.	1845.	1845.	1845.	
1	October 13	October 13	October 15	October 11	1
2	November 4	November 5	November 13	October 28	2
3	December 9	December 13	December 14	December 7	3
	1846.	1846.	1846.	1846.	
4	January 29	February 1	February 4	January 24	4
5	February 20	February 25	February 24	February 14	5
6	March 14	March 16	March 26	March 6	6
7	April 5	April 11	April 19	March 30	7
8	May 4	May 6	May 9	April 25	8
9	May 28	May 30	June 1	May 11	9
10	June 25	July 1	July 2	June 12	10
11	July 23	July 26	July 28	July 9	11
12	August 13	August 19	August 26	August 1	12
13	September 14	September 27	September 27	September 3	13
14	October 16	November 8	October 30	September 22	14
	1847.				
15	November 4	February 24	November 23	October 14	15
			1847.		
16	December 21	March 27	January 5	January 14	16
	1847.				
17	January 24	April 23	February 1	February 23	1
18	February 27	May 15	March 1	March 25	18
19	March 23	June 13	March 28		19
20	April 15	July 25	May 15		20
21	May 26	October 3	August 16		21
22	June 21	October 27			22
23	July 26	November 19			23
24	September 13	December 15			24
	1848.				
25	October 28	February 9			25
26	November 24	March 5			26
	1848.				
27	January 9	April 1			27
28	February 2	April 28			28
29	April 10	May 1			29
30	May 22	September 7			30
31	June 22				31
32	July 19				32
33	August 13				33
34	September 14				34

The process of sloughing is very interesting. Eight days usually, but from eight to ten days, before an animal throws off its scaly covering, it assumes a peculiar opaqueness, and seems less active. On the fourth or fifth day the original colour is gradually regained, but with less of brightness, and perhaps of a darker shade. On examination about the eighth day, the scales will no longer be found attached to the scale-plates, and the creature is restless. It rubs its head on the grass in the bottom, or on the sides of its box, first on one side, and then on the other, with the evident object of detaching the jaw scales, which it ultimately effects; and so soon as this is the case, the rest of the process may be, and is, performed with apparent ease by muscular action entirely. The scales of the upper jaw being thrown up, and those of the lower jaw down, the head is jerked from side to side till the scales are relieved. A peculiar vermicular action of the body is instituted and kept up, every movement having the effect of gradually sliding the scales back upon each other. But this action does not seem to be entirely local, or directed in such a way as to remove the scales by gradation from the head backwards only, for the action is simultaneous throughout the entire length of the animal. The scales covering the cloacal valve are often carried, by the action alluded to, perhaps an inch backward—by extension—before the head scales are even free; and the scales of the extreme part of the tail are already, it may be, detached from the animal to the extent of from one to two and a half inches, when the upwrinkled slough reaches the extremity. An example of sloughing, which, in one well-observed instance, began at the head and cloaca at the same time (from the scales giving way and separating at that point), more clearly illustrates the peculiar action, for each portion moved backward, as if each had been an independent slough.

The time occupied in sloughing,—that is, from the moment the scales become detached from the head till thrown off,—occupies variously from one to two and a half hours; but with assistance, or, perhaps, with such aids as the animal might seek in a state of freedom, the process may be very quickly completed. So soon as the head scales are free, if the animal

be taken in the hand and allowed to urge itself through the fingers, placed in such a way as to keep back the scales, detachment is effected in a few minutes—the animal, in apparent ecstacy, working its way out of its skin with elevated head and with lightning-like rapidity, playing, in its characteristic way, its long nimble tongue. But there are states, either of the animal itself, or arising from its treatment, when sloughing seems difficult ; the scales seem too dry, are comparatively inflexible, and remain about the body in rings and shreds till bit by bit they are detached.

4. *The Slough.*—The slough, as thrown off from the body, is a mass of scales—not huddled or inverted, but regularly laid one upon another, and compacted into a very small space—an inch or two of the tail portion generally remaining free. When newly detached, the slough may be drawn out to fully one and a half the length of the animal. The scales of the head, which are smooth and very varied in size, are so arranged on the upper jaw as to admit of no extension, while those of the under jaw, with the exception of two rows of small scales which cover the bone, are like the other body scales. The largest scales of the animal are the central ones of the head and those within the angle of the lower jaw, and the smallest are those of the labia and of the eyelids. The scales of the body, individually, are also smooth, somewhat rhomboid, and collectively are arranged in an imbricated manner, each being encroached upon, and encroaching, to the extent of one-third, and each having connection with three above and three below. The point of connection of one scale with another is the upper border, and each reposes on its scale-plate, the edge of the scale extending beyond the plate ; and the whole is united by highly elastic tissue,—an arrangement which admits of great expansion and flexibility.

The usual method of enumerating the scales of snakes is scarcely applicable to this species of reptile, for the scales of the entire body, unlike most serpents, are of uniform character. Counting from the margin of the upper jaw along the back, there were, in a specimen carefully examined, 273 rows of scales in the whole length of the animal—7 in the head,

266 in the body and tail, inclusive of the conical scale which terminates the tail. Counting the scales from the under side, there were in all 278, or five more, the excess being in the lower jaw. From the margin of the lower jaw to the verging scales of the cloaca there were 137, and from this to the point of the tail, 141.

The valve of the cloaca, situated near the middle of the body, produces no interruption of the symmetry, or of a continuous declination; and, indeed, it would be difficult of detection by those who are unacquainted with the structure of serpents. It is a semilunar flap, so to speak, opening transversely, two scales deep, and fringed by six scales, which are adjusted very perfectly to the scales of the tail. A reflection of the cuticular tissue lines this flap, forming on the upper or body side distinct minute scales, merging in a highly elastic network-like structure, which surrounds the cloacal aperture, and is attached below to the marginal scales of the flap. This reflected portion of the scales is always thrown off as part of the slough, and is seen as a sort of pouch in prepared sloughs.

The colours of the animal are derived essentially more from a sort of pigment which covers the scale-plates than from the scales themselves; still, most sloughs have faint brown streaks on the back scales, and the side ones are sometimes tinged of a slight dusky hue; but the scales of the belly, which look dark when in connection with the animal, are always colourless when detached from the body.

The scales and scale-plates are arranged in rows disposed backward from the centre line of the back in an angular manner. There are, however, instances of imperfect rows—a sort of indentation of a partial row, as if to meet some requirement of contour or function.

The rows are, as a rule, of equal numbers, from 28 in the neck to 2 in the tail; but in every animal there are a few unequal rows, and the tail ends with a single conical scale.

The scales in the upper jaw number	160
In the under jaw	...
	117
	— 277

In body there are 23 rows of	28 scales	644
... 3	27 ...	81
... 33	26 ...	858
... 29	24 ...	696
... 3	23 ...	69
... 27	22 ...	594
Ending in cloaca 5	16 ...	80
		— 3022
Below cloaca 13	14 ...	182
... 3	13 ...	39
... 60	12 ...	720
... 7	11 ...	77
... 43	10 ...	430
... 8	9 ...	72
... 4	8 ...	32
... 1	7 ...	7
... 2	6 ...	12
... 1	2 ...	2
... 1	1 ...	1 1574
		— 4873

This is the result of the examination of only one individual.

Of the body scales, those of the neck are smallest and most numerous, admitting, consequently, of considerable expansion—a condition particularly suited to the requirements of the animal, which swallows its food entire, and often gorges slugs of a size greatly disproportioned to its apparent capacity.

Though not very evident to the eye that the scales of the body differ much in size, the fact is established. In a slough minutely examined, there were in one portion of the body 29 rows of 24 scales each ; at the upper part it measured 22, and at the lowest $20\frac{1}{2}$ lines. Above the cloaca there were found 27 rows of 22 scales each ; at the upper portion it measured $20\frac{1}{2}$, and at the lower 17 lines. In the tail there were 60 rows of 12 scales each ; the upper row measured 14, and the under 12 lines. Still lower in the tail there were 43 rows of 10 scales each, the upper row being 12, and the lower $8\frac{1}{2}$ lines. In sloughing, all the scales of the body are thrown off, including those of the eyelid ; but the eyeball does not, though a common belief, cast a film as part of the slough, as occurs in serpents.

5. *Fragility*.—Nature, always bountiful in her provisions for defence or preservation, has given to the *Anguis fragilis* one which, if repulsive to mere observers, is no doubt that best fitted to its peculiar character. It does not bite,—at least

in no instance, during years of daily handling, did I ever observe the slightest approach at defence by this mode; motion is comparatively slow; and it has no adequate defensive armour. The animal must seek its food; but this is generally done without much exposure, for it feeds on slugs, &c., found low in the grass, where, too, from its mode of progression, it is most active and powerful. Sometimes, however, it is found extended as if basking in the sun (probably while incubating, if the phrase can be sanctioned) on sand-beds, or on cultivated ground, helpless, in a great degree, from the want of aids of motion in such situations, and consequently is an open prey to the enemy. But whether in the grass, or thus exposed, it is easily found by the sparrow-hawk (*Accipiter fringillarus*), its most conspicuous foe, which, at the season of the activity of the reptile, may be frequently observed hovering on wing above the sloping banks facing the south, where the animal is most plentiful. When once marked, escape is scarcely possible; but the provision alluded to affords considerable immunity from attack. If the bird seize its prey at any point below the cloaca, the reptile has the power of sundering the part with apparent impunity, and escapes; and if in any way forewarned of danger, the retreat of the animal to the nearest crevice would favour the probability of such a result. Many mutilated specimens are found; and it is scarcely possible to keep numbers that are subjected to daily examination without being a witness to the act which instinct prompts, and which seems to cause little pain or inconvenience. There are sure grounds for affirming that the "breaking in two" of authors is limited to the tail. If violently seized by the body, the tail is, nevertheless, the part thrown off. When a part of the tail is separated from the animal by its own efforts, there seems to be no laceration of the structures, if the vessels and cellular tissue are excepted. Not a scale is torn. Eight conical processes (four pairs), with interspaces between them, project from each severed part, and each projection consists of one-half of a short muscle which fits or dovetails into the other. The body part has the ball, and the tail part the socket, of the vertebræ. So

easy and harmless does this act of the animal appear, that it may almost be classed among the functions.

6. *Reproduction of Parts.*—No sooner is the animal subjected to mutilation than the reparative, and, to a certain extent, reproductive, process is instituted. If the loss has been the result of the instinctive efforts of the animal, the parts seem very rugged and irregular, though, on examination, a sort of three-fold dislocation is found to have taken place—scale from scale, muscle from muscle, vertebra from vertebra. As in other animals in similar circumstances, lymph is thrown out, which at first covers the stump, and from day to day is added to, till there is a prolongation of a conical form to the extent of about half-an-inch, the reproduced part varying in length and form in almost every case—a result depending, apparently, on the stage of growth at which the animal has arrived. This new structure is at first covered by an imperfect envelope, which comes off with the slough; but in the course of time (from four to six months) scales are formed, and the reproductive process is at an end. In the case of an aged animal, the reproduced part, at 3 inches below the cloaca, is 5 lines; and in a younger specimen, at 2 inches below the cloaca, the reproduced part is 7 lines in length—the first being composed of seven rows of scales, and the other of ten rows, including, in both cases, the terminal conical scale. The scale-plates and scales of the reproduced part are comparatively strong, small, and numerous. In the first case, the part was separated where the scales are ten in number in the circumference of the tail; the new scales, at the point of union with the old, are twenty in number. In the other case, the scales at the severed part are twelve; those of the reproduced portion, at the point of union, amount to eighteen. Vertebræ are not reproduced.

7. *Gestation and Hibernation.*—The periods of hibernation and of gestation of the *Anguis fragilis* I have never been able to determine by the closest observation. The artificial method of keeping reptiles, necessarily adopted by the naturalist for acquiring a minute knowledge of their habits, is not the best for all purposes. The more equal temperature

of a house, and confinement in boxes, are alike unsuited for successful results. In all instances, in the natural state, hibernation must vary with the setting in of winter and spring respectively. As to gestation, if the reptile, in this country, has only one set of young in the year, which I am disposed to believe; and granting that it follows other cold-blooded animals to which it has some affinity, in making the reproduction of species its first effort after the slumbers of the winter; and granting, also, that it has been rarely found in activity in Clydesdale earlier than the middle of April, I would be disposed to fix about four months as the period of gestation; because, in every instance within my observation, the impregnated specimens found produced their young or eggs late in August or early in September.

On 3d September 1845 a litter was hatched all but under my own eye, and I had the parent in my possession from the preceding June. On opening the box in which it was confined, I found seven young in great activity, with the foetal vascular tissues, still fresh, attached to the cloacal valve, and four eggs—membranous oblong bodies, little larger than a field bean—three of which ultimately yielded their living contents, and one remained entire, with the young one visible within. The young at this stage of existence were from 33 to 36 lines long, not thicker than a small earth-worm, and weighed from 11 to 13 grains. In this way I became possessed of ten objects of special interest. During the first day, one was, no doubt, devoured by its parent, for I found half of the tail unconsumed, which the little creature had in all probability wriggled off in an instinctive struggle. On procuring small slugs, the young reptiles pounced upon them with artful avidity; and so voracious were they, that one of the slugs provided for the old animal was seized upon, although ten times the weight of the creature that made the bold attempt. It was amusing to see the slug moving on in its even course, with the slender reptile attached, tugging in vain for the victory. Though all did not grow equally, they on an average gained about an inch in length, with a proportionate growth otherwise, monthly, for the first year. Among my stock I fre-

quently had aborted eggs, apparently all yolk. In spring, these inoffensive reptiles became among themselves pugnacious. Two individuals, in particular, I had frequently occasion to separate from what appeared a death struggle ; and as the violence was, in a sense, exceptional, I considered the *causa belli* to be sexual.

8. *Feeding, Motions, &c.*—This reptile shuns the light, and is often found in long grass, or under the new laid swath, where food is likely to be found. In seizing its prey something like a display of strategy is made. The object is marked, the animal hovers over its victim, arches its neck, and ultimately, though the action seems unnecessary, darts upon it. Whatever is seized is gorged, and apparently all but impossible masses are swallowed. I have seen—besides slugs, which it seems to prefer, and worms which it feeds on readily—very small frogs and toads, and also caterpillars, to which it was restricted, taken ; and I have good grounds for believing that its own young are not rejected. The manner of seizing its prey would suggest that it has to deal in a state of liberty with animals more active than the snail or worm. The gorging process is slow but certain ; the snail being caught, the slow-worm rests for a considerable time, when a sort of convulsive opening and shutting of the jaws take place—a pause and similar efforts occurring at what seems measured intervals, till the object disappears within the jaws. A circumstance which long puzzled my discerning powers, may be worth notice : I remarked that the bulging mouthful, made by a large slug, acquired a singular impulse inwards each time the mouth was *opened*, and that although the mouth was opened comparatively slowly, an instant snap succeeded, as if to make good the advantage. After careful watching, and a thorough examination of the machinery, I came to the conclusion that the peculiar teeth of fishes and of reptiles were contrived not only as seizing and retaining instruments, but that in the opening of the mouth a necessary mechanical power was exercised by the curved teeth, which effected, in animals so constructed, the needful purpose of advancing, at every such effort, the peculiar nutriment. The animal drinks equally

slowly. If the water be on a level with its body, it elevates its head, curves its neck, and projects its long, notched tongue into the fluid, withdrawing and projecting it sluggishly for a considerable time. When satiated it seems delighted, raises its head high, waving it to and fro, performing something like smacking the lips, and accompanying the act with an audible chirp, a sound rarely heard at other times. Many were easily trained to take a drop of water from the tip of the finger.

Upon a flat surface the motions of the animal are awkward and ineffectual; among grass, on the contrary, it urges itself on sweepingly, in a sinuous course, the sides of the body and tail being the motive agents. It has a very perfect reversing action—the retrograde motion without the slightest doubt; and, in addition, it has a sort of prehensile power in its tail, by which it can suspend its body. The respiration is peculiar; the animal expires at distant intervals, but no sooner is the expiration made than inspiration follows. In motion, like serpents, the animal is constantly darting out its long, partially-cleft tongue. When in vigour, as in a fine warm day, the act is like one rapid dash; but when less energetic, as in the cold of the morning, the action can be made out very distinctly to consist of three distinct waggles of the tongue up and down. I have long sought to interpret this singular act without success; but I am disposed to think it has something to do either with the search after food, or with discerning obstacles.

Skeleton.—The most notable peculiarity of the bony framework of this animal, and those of the same type, is the well-known existence of vestiges of the agents of locomotion—the rudiments of a quadruped form. In the shoulder there are most distinct scapulæ, clavicles, and a sternum; in the pelvis, besides an expansion of vertebræ, with fixed and enlarged lateral spines, there is a small bone on each side, scarcely connected with the wings of the superior sacral vertebra, which may be viewed either as a sort of completion of the circle of the pelvis, or as representing the bones of the leg.

But there are other peculiarities in the skeleton worth noting, which may not have been recorded.

In determining the co-relation of scale-plates and scales, I

had at first concluded that the former were all strictly dermal. On carefully removing this bony investiture, however, plate by plate from the head, it was found that several plates, which in every other part of the body are dermal, had assumed the character of permanent bones of the head at and around the vertex. This is a condition which may probably exist in other animals of the same type. In the alligator, and its allies, something of a similar nature occurs, and in the saurians of the coal age, there is what may be pronounced a strictly identical arrangement.

In studying the skeleton of the serpent, one is constrained to view it as essentially a vertebral column, of very admirable workmanship and adaptation, surmounted by a head which, small as it is comparatively, seems principally to be occupied in giving place and development for the sentient organs, but which, besides, in the venomous tribes, is a startling array of delicate and appropriate machinery for supply and defence; in the innocuous serpents for the former purpose only, so arranged as to encompass what may be viewed as an enlarged or elongated vertebra, the brain-pan proper, forming a small portion of the head, namely, in the slow-worm, one-third in length, or 1-78th of that of the entire animal.

In the *Anguis fragilis* the bones of the head are more compact than those of serpents. It has a single row of teeth in each jaw, widely apart, on a bony setting, and so placed that, viewed from without, half the length of the basement portion is concealed by an over-lapping part of the jawbone, the pointed and curved portion only being seen above the edge of the bone; an arrangement closely analogous to that observed in the bone-clad sauroids of the carboniferous epoch.

The number of vertebræ in the whole length of the animal is 132; but if advantage be taken of a peculiar subdivision of the caudal portion, to be afterwards adverted to, the number will be considerably greater. The whole column may be arranged into 2 vertebræ in the neck, 58 in the trunk, 1 in the lumbar region, 2 in the sacrum or pelvis, and 69 in the tail.

The cervical consist of the atlas and dentata, which are very easily distinguished from each other, the atlas having

two sockets, as in serpents, one which receives the ball of the occipital bone, and the other which receives the tooth of the dentata ; the dentata having two balls, the tooth anteriorly, and the ball common to all the vertebræ, with the exception noted, posteriorly. The vertebræ of the body are constructed on a more simple plan than in the serpent : each has eight articular surfaces, the socket, the ball, two articular convex processes for the ribs, and four articular facets. The internal aspect is destitute of any process ; the animal, accordingly, unlike serpents, has no muscular arrangement on the inner surface of the spinal column ; and the processes (apart from the ribs, which are well equipped for motion), for muscular action externally, are small, all indicating a comparatively feeble action in that region. The vertebræ of the body of serpents, on the contrary, have each twelve articular surfaces, and have strong internal and external spines, with a corresponding muscular provision.

The last vertebra of the body may fairly enough be reckoned as the representative of a lumbar division ; for although sometimes provided with lateral articular convexities, like the vertebræ of the body, and the short processes which represent the ribs are moveable, or one may be moveable and the other not ; still, it most frequently happens that both are fixed, and, in this respect, is more like a caudal vertebra. The two sacral vertebræ have comparatively large lateral spines, and are developed appropriately for the cloacal and generative functions. The vertebræ of the tail, to a greater degree than in any of the long-tailed serpents I have examined, have a construction suited alike for quick, powerful, and varied action. Each member is furnished with six articular surfaces, and with four long spines, a superior, two lateral, and an inferior, which last is divided at its base, giving it the form of a pointed arch, in which the vessels, &c., find a secure passage.

But each caudal vertebra, with the exception of a few near the pelvis, has in itself a sort of spike-and-facet joint, the anterior third, consisting of the socket and anterior articular facets, being moveable upon the posterior and larger portion. When the extreme flexibility and strength of this part is considered, the provision thus exemplified is at once seen to be

simple and adequate. So far as my observations have extended, this peculiarity of the caudal vertebræ is unique, though the same, or some modification of it, may be expected to be found in those reptiles which have a similar action of the tail.

Viscera.—The conservative and generative organs of the *Anguis fragilis*, are all but identical with those of serpents.

Diseases.—The morbid states of the animal, which I have marked, resulted probably from faults in management, in a great degree; but as numerous specimens were treated alike, and deaths were unfrequent, the causes were not distinctly traced to this source. Impaction of the rectum by a chalky matter, which appeared in every healthy dejection, to some extent, was, apparently, the cause of death in several instances. In a few instances death seemed to result from retention of numerous unvivified ova. But one specimen, which was long carefully watched, with tumours of the lower jaw, and point of the tail, furnished, on inspection, an example of positive disease. In this instance great enlargement and induration of the kidney on the left side was found to exist. Destruction of some of the vertebræ was also found; a state which might have been ascribed to pressure of the enlarged kidney, had not the external tumours been accompanied with absorption of bone of the adjacent parts. The disease, in this instance, was therefore probably malignant in character.

The communication was illustrated by specimens, and by an interesting series of preparations of different parts of the animal.

A vote of thanks was cordially given to the author for his valuable contribution to the natural history of a reptile hitherto imperfectly described.

Professor FLEMING made some remarks on the very local distribution of the Slow-Worm, its great scarcity or total absence in this neighbourhood, and its apparent frequency in Clydesdale.

GEORGE LOGAN, Esq., W.S., mentioned he had taken one some years ago in Presmennan Wood, Berwickshire, which he kept alive for some time; he also corroborated the entire want of any attempt at resistance by biting shown by this curious reptile.

III. *On Hydractinia Echinata.* By T. STRETHILL WRIGHT, M.D.,
Fellow of the Royal College of Physicians, Edinburgh.

Explanation of Plates.

PLATE VIII.

Fig. 1. Diagram showing the various polypoid forms observed on the (female) polypary—*a*, spiral polyp—*b*, reproductive polyp—*c*, alimentary polyp—*d*, sessile ovary—*e*, tentacular polyp.

2. Solid grooved papilla of corallum.

3. Hollow papilla of corallum.

4. Ideal section of the extremity of one of the propagative stolons—*a*, “colletoderm”—*b*, corallum—*c*, ectoderm—*d*, endoderm.

5. Spermatic capsule of reproductive polyp of male polypary—*a*, ectoderm—*b*, muscular coat—*c*, endoderm—*d*, gelatinous plasma, in which spermatozoa are developed.

6. Ovarian capsule of reproductive polyp of female polypary—*a*, ectoderm—*b*, muscular coat—*c*, endoderm—*d*, ova.

7. Fecundated ovum segmented by yolk cleavage.

8. Larva studded with motionless “palpocils.”

9. Young polypary and polyp.

10. Spiral polyps covered with large thread-cells.

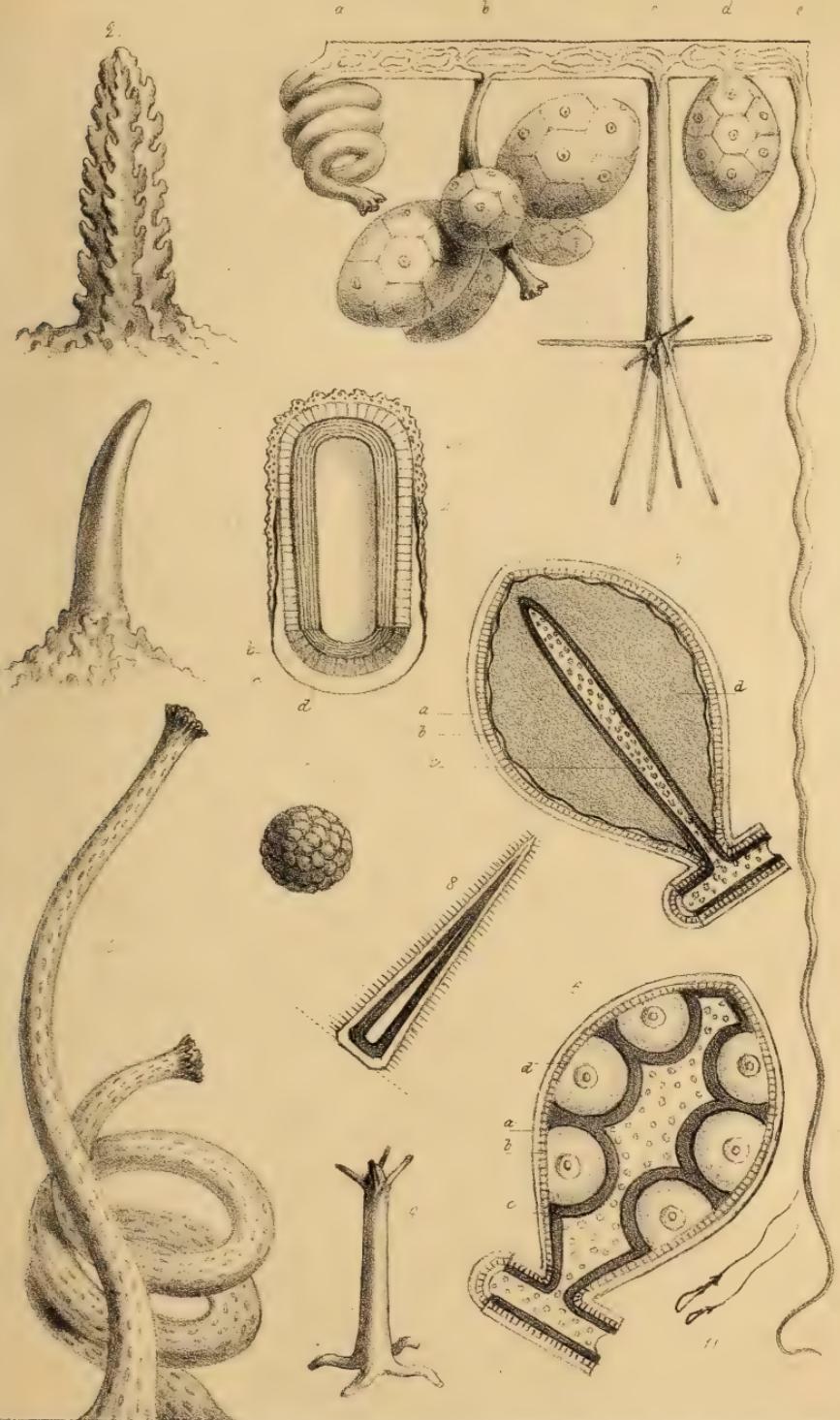
11. Large and small thread-cells.

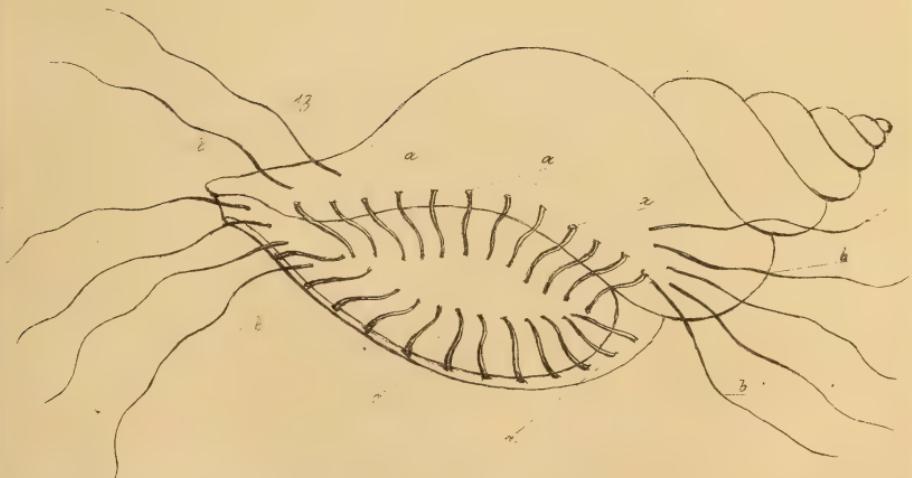
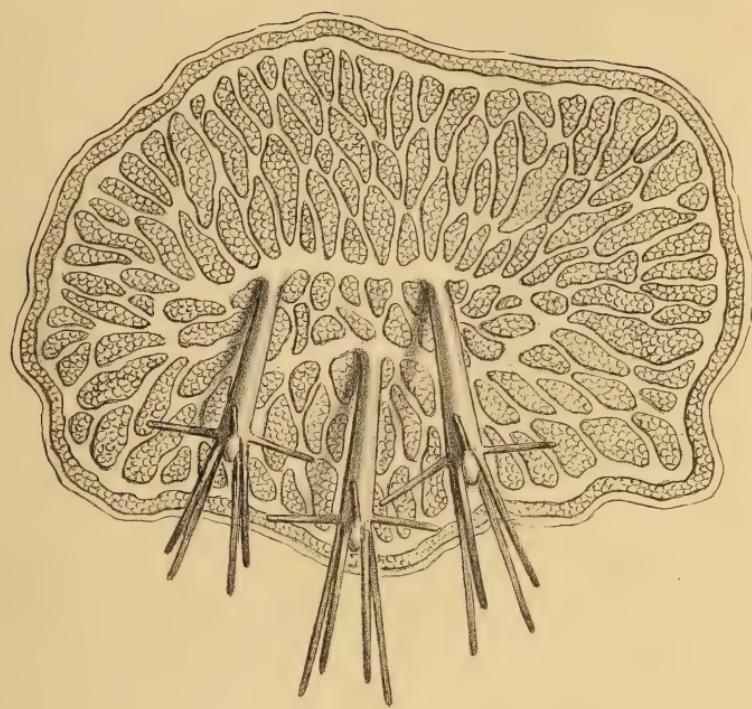
PLATE IX.

Fig. 12. Young polypary attached to side of tank, showing tubular net-work of the endoderm.

13. Diagram showing the situation of spiral polyps *a*, and tentacular polyps *b*.

1. In rock pools left exposed by the retiring tide on the shores of the Firth of Forth, numerous Paguri, or hermit crabs are found, inhabiting old turbinate shells, formerly occupied by various species of Buccinum and Fusus. The rough and worn surfaces of these shells also form convenient homes for a great variety of animals, and frequently afford a strange scene of thronged and busy life. In the spring they present the naturalist with a rich field for observation. He will find the fixed and blind Balani, hidden in their mailed armour, winnowing the water with their fan-like cirri, and vomiting forth swarms of bright-eyed and actively swimming larvæ. There the Spio incessantly tosses about her long arms; the Serpula





expands its many-coloured branchial plumes ; Lepralia and other Polyzoa display their vase-like crowns of ciliated tentacles ; and forests of Zoothamnium (an arborescent vorticella resembling a miniature sea-fan) extend their branches and wheel-bearing heads, or quickly coil up their writhing stalks in a compact ball at the approach of danger. All these, and many other forms of life, hurried through the water on the house of the scrambling crab, doubtless profit by the constant renewal of the vital element, and partake of the good fare enjoyed by the eremite within.

2. One of the most frequent cotenants of the abode of the *Pagurus* is the *Hydractinia echinata*. Shells infested by this zoophyte appear to be covered by a white shaggy fleece, which consists of a host of hydroid polyps, closely aggregated together as the stalks in a field of corn.

These polyps appear to be careless of the rough motions of the crab, and wave loosely to and fro as it jolts along over the rocks ; but when any part of the colony is rudely touched, the whole of the polyps contract *en masse*, and seem to sink down into the substance of the shell. A close examination shows that this instantaneous action on the part of the polyps is caused by their being all developed from a common membranous basis, which spreads itself in a continuous thin layer over the shell, and being intimately connected with their tissues, forms a bond of sympathy between the whole assemblage.

3. The subject of the present communication is by no means new to science. It has been treated of by Fleming, Johnston, Gray, Couch, Hassall, M'Gillivray, Van Beneden, and especially by Quatrefages, whose monograph on this zoophyte is replete with interest. After reading the memoirs of these philosophers, I became convinced that a complete conception of the morphology of *Hydractinia* had not been attained by any of them. This I had previously been attempting to work out by the examination of some hundreds of specimens, many of which had existed for months confined in glass vessels, and propagating themselves by stolons and sexual reproduction. The conclusions I have come to may be briefly stated as follows :—In *Hydractinia*, the polypary, or common connecting membrane is to be considered as an individual animal, possess-

ing alimentary and sexual organs polypoid in form. Each polypary is unisexual or dioecious; male and female organs being never situated on the same polypary, or on the same shell! The polypary, in addition to its alimentary and sexual polyps, possesses additional organs of prehension and offence, hitherto undescribed, which have a determinate situation. It is also furnished with corallum or skeleton, which, although widely differing in form from the coralla of other hydroid zoophytes, is identical with them in chemical composition and mode of secretion.

Anatomy of Hydractinia.

4. A consideration of the anatomy of *Hydractinia* may be conveniently divided into three parts:

1st, The Corallum or polypidom, the horny skeleton of the zoophyte.

2d, The Polypary, or common body.

3d, The Polyps.

The Corallum.

5. *The Corallum* is a layer of transparent amber-coloured chitine; a substance having the consistence of horn, but differing from it in chemical composition. It closely invests that part of the shell inhabited by the zoophyte. Its structure is very dense at the mouth of the shell, where it frequently (as remarked by Johnston) forms a slight extension of the whorl. As it passes backward, it gradually takes the form of a fine indurated membrane beset with spicules of irregular shape. Delicate and transparent casts of entire shells are thus occasionally formed, which may be removed uninjured by the aid of consecutive solutions of nitric acid and caustic potash. I have placed one of these on the table; and it will be seen that the surface, with all its parasitical growths, is copied with the fidelity of the electrotype. Over the more exposed parts of the corallum, the chitine rises up in the form of thickly set papillæ or spines, which have their surfaces furrowed by deep longitudinal grooves (fig. 2). The ridges between these grooves are coarsely lobed or serrated, and after passing from the summit to the bases of the spines, traverse the corallum, and unite with each other, and with the ridges of the neighbouring papillæ, so as to form a raised

network, intersecting the surface in every direction. The structure of many of the spines differs somewhat from that above described; some being hollow smooth cones, slightly grooved or reticulated only at their base (fig. 3); while others have their ridges pierced everywhere by foramina, and united by irregular transverse bands, until they become a mere fenestrated structure of interlacing fibres. More rarely, we find the spines here and there fused together in long serrated ridges, running parallel with, or fitting into each other in a variety of intricate patterns. Quatrefages has described the corallum as an endoskeleton deposited in the substance of the polypary, like the solid axis of *Gorgonia*. But I am satisfied that his views on this point are incorrect, and that its mode of secretion differs in no essential from that of the corallum of other hydroid zoophytes.

The Polypary.

6. The polypary consists of a layer of semi-transparent fleshy matter (either colourless, or tinted with light shades of yellow, buff, or pink), which invests the corallum, and fills up the grooves of its papillæ, the interstices between its reticulations, and the cavities of its hollow spines. It is often absent at the summits of the papillæ, and is so thin over their ridges, that the serratures appear through it as fine undulating lines.

7. *The Polypary* is the most important part of the zoophyte. It secretes the corallum, renews it when injured, and extends it along the shell. From it the polyps are developed; and it represents the trunk by which the whole assembly are united to form a single plant-like animal.

8. Quatrefages states, that the polypary is underlaid by a network of tubular fibres, which pass between the polyps, and unite their alimentary canals with each other. The existence of this structure has been doubted by Dr Johnston, and altogether denied by Van Beneden; but I have repeatedly detected the tubes *permeating*, rather than underlying, the polypary, and have watched their development day by day, in portions of that body growing over a transparent surface.

9. In the less exposed parts of the shell the polypary frequently passes beyond the papillary corallum as a thin mem-

branous expansion, or breaks into a loose network of delicate anastomosing tubes, which traverse every cranny and furrow of the shell, and can only be detected after their tissues have been coagulated by immersion in alcohol. On these, polyps are developed at long intervals; and in the larger tubes an intermittent circulation of shining globules may be detected by the aid of high microscopic power and direct sunlight. In specimens which have been long kept in captivity I have seen these fibres throw up thick white stolons or suckers, tipped with crimson, some of which have attached themselves to the sides of the tank, expanded themselves into independent polyparies, and afterwards put forth clusters of polyps. The small living specimen on the table, of which fig. 12 is a drawing, has been propagated in this way, and shows the tubular structure of the polypary in an admirable manner.

10. The life of the polypary is not dependent on the presence of the polyps. Many specimens of *Hydractinia* occur in the winter, in which the polypary exists in a high state of development, although its polyps are very few in number, or altogether absent, and which nevertheless become clothed with these organs on the return of spring.

11. The minute anatomical structure of the polypary, the nature of its connection with the corallum, and the mode of secretion of the latter, cannot readily be investigated in those specimens of *Hydractinia* which are parasitic on the shell of the *Pagurus*, as the zoophyte is broken up by an attempt to remove it from its site. A better opportunity for observation is afforded when the animal has extended itself along a transparent surface. The propagative stolon of *Hydractinia*, after leaving the point of its origin, increases rapidly in diameter, and throws out irregular branches, not unlike a very minute specimen of *Tubularia larynx*. The tips of these branches are covered with a glutinous cement, by which they attach themselves tenaciously to glass or other surface near them. Having attached themselves, they expand laterally, at the same time throwing out finger-like prolongations, which, as they come in contact with each other, coalesce, until a fleshy plate is formed adherent to the glass. Polyps are developed both from the loose branches and the attached poly-

paries; and the latter is clearly seen to be permeated by a beautiful system of anastomosing canals (fig. 12) connected with the hollow bodies of the polyps. Within these canals may be detected an intermittent flow of fluid, containing particles, the dancing motion of which indicates the presence of ciliary action, and which, having passed in one direction for a short time, are arrested, and, after a slight period of oscillation, commence to flow in an opposite direction.

12. A few branches of one of the tubular stolons was submitted to a microscopic power of 600 diameters. They were found to be composed (fig. 4), as is the polypary of every hydroid zoophyte, of an external and internal membrane,—the “ectoderm” (*c*), and “endoderm” (*d*) of Allman,—inclosed in a wide tube or corallum of transparent chitine (*b*). At the growing extremities of the branches the corallum was absent, and its place supplied by an epidermis (*a*), a soft, glutinous layer closely investing the ectoderm.* Further down the branch the corallum appeared, secreted by the ectoderm beneath the epidermis, by which last substance it continued coated, and from which it derived its adhesive property. A delicate chitinous investment may also be detected on the creeping tubular fibres from which the stolons of *Hydractinia* take their rise; but I have not satisfied myself as to its presence on the entire upper surface of adult polyparies. In specimens of *Hydractinia*, however, growing in the shell, we find that the spines of the corallum, although varying in shape and structure, may be classed in two divisions; the one, solid and deeply grooved, and clothed by the polypary (fig. 2); the other, smooth, conical, and hollow, and inclosing a process of the polypary in their interior (fig. 3).

13. From the above observations, I conclude that the polypary of this zoophyte consists of a single layer of endoderm, inclosed between two layers of ectoderm. That the *lower ectodermic layer*, as it grows over the shell, attaches itself by its “colletoderm,” and secretes the horny plate of the coral-

* This layer which I have called the “colletoderm,” (*κολλητός* glutinato), is constantly found covering the coralla of creeping zoophytes, where it frequently forms a coat of considerable thickness, continued, also, as in *Coryne*, over the body of the polyp.

lum. On this plate, by a further process of secretion from the lower ectoderm, the *grooved* spines are erected. That the *upper layer of the ectoderm* is naked over the greater part of its surface, or only covered by a thin epidermis; but occasionally this layer also takes its share in the secretion of the corallum, and in that event produces the smooth, conical spines, the concavity of which it fills.

14. I have been unable to detect the existence of true cells either in the endoderm or ectoderm of the polypary. These membranes appear to consist essentially of structureless modifications of elemental tissue, more or less vacuolated, similar to that we find in the protozoa, and to which the term "sarcodæ" has been applied by Dujardin. Accordingly, we find that the finger-like processes given off at the borders of the polypary constantly flow into each other when they meet, like the prolongations of sarcodæ projected from the pores of the Rhizopoda, or the outer layer of *Actinophrys*.

15. The walls of the tubes which permeate the polypary are frequently loaded with the coarse granular matter of a brown-yellow or crimson colour, which is found in the endodermic tissue of all hydroid polyps. This matter has been considered by some authors as a glandular secretion of the nature of bile. It appears to me to be identical with the brown matter which exists in the bodies of many of the Protozoa, such as *Vorticella campanulata*, and which in other species of the same genus is replaced by a substance having all the properties of chlorophyll. In the *Hydra viridis*, also, we find green globules possessing the chemical reactions of chlorophyll substituted for brown matter in the endoderm. Whatever purpose this granular matter may serve in the economy of the hydroidæ, it always occurs in excess in situations where the vital functions are most actively carried on; such as the tips of growing stolons, the alimentary tubes of the polyps, and the ovaries and spermatic sacs.

16. *The Ectoderm of the Polypary* contains great numbers of the highly refractive capsular bodies to which the terms "tricho-cysts," "thread-cells," or "stinging organs," have been applied. They are of two kinds (fig. 11), differing very distinctly in size; the larger exceeding the smaller ones by

about a diameter and a half. In shape they resemble somewhat a grain of wheat, being respectively flattened and slightly rounded on opposite sides. They are contained within small cells in the ectoderm, and possess dense coats, which, under pressure, burst at one extremity, and protrude a four-barbed dart, from the point of which projects a long stiff thread or hair (fig. 5). These thread-cells, found extensively in all classes of polyps and acalephs, are, I have no doubt, true organs of offence, as I have detected numbers of them plunged beyond the barbs in the soft bodies of worms, rescued from the grasp of *Hydra vulgaris*. But it is to be remarked, that they frequently exist in situations where their mischievous properties are rendered innocuous by the dense coverings under which they lie hid. Thus we find them congregated in masses on the polypary, beneath the thick corallum of *Coryne glandulosa* (Dalyell); and in *Halecium Beanii*, while the naked polyps are armed with unbarbed thread-cells of the most minute and simple kind, these bodies attain a giant size and formidably spinous development of the thread beneath the hard coverings of the reproductive capsules and the corallum.

The Polyps.

17. The polypoid appendages of *Hydractinia* are of five kinds (fig. 1) :—

1. The Alimentary Polyps, possessing mouth and tentacles (*c*).
2. The Reproductive Polyps, destitute of mouth, and having only rudimentary tentacles (*b*).
3. The Sessile Ovisacs and Spermsacs of the Polypary (*d*).
 4. The Ophidian, or Spiral Polyps (*a*).
5. The Tentacular Polyps, or great Tentacles of the Polypary (*d*).

18. *The Alimentary Polyps.*—These organs, which represent the prehensile and digestive systems of the zoophyte, first make their appearance as a thickening of the endoderm in one of the canals of the polypary, attended with a copious deposit of red granular matter. This thickening in a few hours rises from the surface in the form of a fleshy stem, on the summit of which an oral aperture presently appears surrounded by

four small pullulating tentacles. When perfectly formed, these polyps are about half an inch in length, club-shaped, and furnished with from eight to thirty tentacles, placed in two alternating rows. Those of the upper row, which are about twice the length of the lower row, are held nearly parallel with each other above the mouth, while the lower row are extended at right angles to the axis of the body,—an exaggerated state of a disposition frequently observed in Sertularian and Campanularian polyps. The mouth opens into a buccal cavity, contained within a more or less elongated papilla, which rises in the centre of the circle of tentacles. This papilla is exceedingly distensible, frequently expanding itself into a wide discoid sucker, as shown in the figures of Quatrefages, and even folding itself backwards, so as to conceal the tentacles, and completely evert the body. A similar habit has been observed by Dr Coldstream in the polyp of *Clava*, and by myself in *Coryne pusilla*.

19. The body of the polyp consists of the same elementary tissues as the polypary, with the addition of a muscular tunic, which is interposed between the endoderm and ectoderm.

20. *The Ectoderm* of the alimentary polyp is a transparent, homogeneous membrane, containing molecular matter, also transparent, but of higher refractive power; so that expansions of this tissue have a finely-dotted appearance under the highest powers of the microscope. The ectodermic layer also contains multitudes of thread-cells of the *smaller kind*. These are amassed in the greatest numbers at the upper parts and ends of the tentacles. Over the site of each thread-cell a very delicate soft spine or cilium may be observed projecting from the ectoderm, and apparently springing from the thread-cell itself. Similar spines exist over the smaller thread-cells of *Hydra vulgaris*, and those of Sertularian and Campanularian polyps. Now, when the thread-cells of these hydroidæ are displaced by gentle pressure, so as not to burst them, they are found to have a perfectly smooth contour. Moreover, the ectoderm of the planarioïd larva of *Hydractinia* is thickly studded with these spines before any development of thread-cells has taken place. These spines also occur in various tribes of the mollusca; for instance, on the very adhesive tentacles which fringe the inner edge of the mantle of *Lima*,

and on the tips of the branchial papillæ of Eolis. I am led to conclude, therefore, that they are tactile prolongations of the ectoderm, analogous to the prehensile processes of *Actinophrys*, or the long rays of *Podophrya*, and that their function is probably to distinguish and seize the prey, and to convey the stimulus necessary to effect the rupture of the death-dealing thread-cells immediately beneath.*

21. *The Muscular Coat* consists of a layer of closely-set, ribbon-shaped fibres, passing upwards from the polypary to the tips of the tentacles, so as to form a continuous tunic between the endoderm and ectoderm more transparent than either. It shows no indications of transverse striae; but it exercises considerable depolarizing power on polarized light,—a property possessed by both striated and unstriated muscular fibre. There can be little doubt that all the tissues of the polyp have the property of slow contractability; but the muscular tunic appears to be specially adapted for the quick withdrawal of the polyp body between the sheltering spines of the corallum.

22. *The Endoderm* of the polyp is a finely-granular opalescent tissue, darker by transmitted light, and whiter by reflected light, than the ectoderm. Its appearance differs so remarkably in various polyps of the same polypary, that the observer might, with Quatrefages, be induced to represent it as a compound of many different tissues. In its simplest form, as it generally occurs in the reproductive polyps, it is a structureless membrane, similar to the ectoderm, deeply loaded with coloured granular matter, and ciliated on its internal surface. In other polyps the endoderm is extensively vacuolated, or filled with cavities, until it appears to consist of a congeries of cells of every variety in size. In a third class, again, the vacuolation is still more extensive. Here the membrane has the appearance of being split into two layers, one of which forms an intestinal tube, occupying the axis of the body, while the other lines the muscular tunic; the two being intimately connected by an areolar network of fibres, or septa,

* As these processes have not been hitherto noticed, I propose to distinguish them by the appellation of "palpocils."

or irregular cells. The endoderm of the tentacles possesses a similar variety in structure. I have not been able to satisfy myself of the existence of a canal in their interior.

The internal surface of the endoderm has the function of nutrition ; its external surface that of reproduction.

23. *The Reproductive Polypoid Organs* (fig. 1. b), male and female, are always situated on separate unisexual polyparies.

24. The *Male Polyp* is smaller than the alimentary polyp. The buccal cavity and mouth appear to be absent ; but I have occasionally seen the place of the latter marked by a whitish spot, through which I have succeeded in forcing the contents of the intestine. The tentacles are merely small protuberances, thickly studded with the *larger* thread-cells, which bodies also occur over the whole surface of the polyp. The parietes of the body consist of the same three elements as that of the alimentary polyp. Their middle third is dilated into a sac, from which numerous diverticulae protrude, to form spermatic capsules (fig. 5). The endoderm of the sac and capsules is richly ciliated, and loaded with brown granular matter ; and between all the communicating cavities a constant circulation of fluid, charged with globules of sarcode, takes place with a powerful rotatory turmoil. At first, all the coats of the capsules are in close apposition to each other ; but, as they increase in size, the endoderm (c) becomes widely separated from the other coats, by the secretion from its outer surface of a dense transparent gelatinous matter. The transparency of this matter, after a time, becomes obscured by the formation within it of innumerable minute cells, from each of which a single spermatozoon is presently developed. After a time, the endodermic layer of the capsules having been reduced by absorption to a mere linear core of brown matter occupying the axis of the capsule, and the spermatic mass having become liquid and white, the latter is at last evacuated from an opening in the summit of the capsule, and descends through the water as an expanding cloud.

25. *The Female Polyp* resembles the male in its form and the development of its generative capsules. But at an early stage of the development of the capsule, from four to nine ova make their appearance between the endoderm and the other

coats, in place of the gelatinous matter secreted in the capsules of the male polyps (fig. 6). These ova, at first consisting of a small transparent vitellus, containing a germinal vesicle and germinal spot, become of an opaque yellow, white, or crimson colour, by the granulation of the yoke, and rapidly enlarge, until the female polyp is almost hidden under the mass of immense ovaries with which it is burthened.

26. *The Sessile Generative Sacs* of the polypary are developed from the tubes of the polypary itself. They resemble exactly those of the reproductive polyp, and contain ova and spermatozoa in the polyparies of different sexes.

27. *Three kinds of reproduction* may be observed to obtain amongst the hydroid zoophytes:—1st, *Polypiparous*, where the young is discharged from the ovarian capsule in the complete form of a polyp, as in *Tubularia*; 2d, *Larviparous*, where the young are born as ciliated planarioid larvæ, as in *Clava*, or simple unciliated germ-masses, as in *Coryne*, afterwards becoming polypoid; and 3dly, *Oviparous*, where true ova are discharged from the ovarian sacs, and the subsequent changes into planarioid and polypoid forms take place after their leaving the parent zoophyte, as in the subject of this paper.

28. In *Hydractinia*, the ova, after extrusion from the ovary, and their having undergone fecundation by the spermatic fluid of a male polypary, become segmented (as in fig. 7) by the usual process of yolk-cleavage, and are transformed into transparent fleshy masses, in which may be detected the rudiments of the endodermic and ectodermic tissues. These masses presently become developed into taper cones (fig. 8), which attach themselves by their bases, travel along the surface of the glass in which they are kept, and congregate on the side next to the light, like a forest of tiny masts. They consist of an *ectoderm*, destitute of thread-cells, but thickly studded with the soft spines I have before mentioned (19), and tenaciously adhering to any body brought in contact with them; and of an *endoderm*,—crimson, granulated, and not vacuolated, inclosing a cavity which occupies the axis of the cone along its whole length. Many of these larvæ have lived for several weeks with me without undergoing any further change; others have in a few days been developed

into small four-tentacled polyps (fig. 9), and protruded creeping tubes from their base,—the rudiments of the future polypary.

29. Quatrefages has figured the male or sperm capsule of *Hydractinia*, and mistaken it for a reproductive "bulbil." Johnston also falls into a similar blunder. Van Beneden, again, has described the male and female polyparies as distinct species, under the name of *Hydractinia lactea* and *rosea*.

30. *The Ophidian, or Spiral Polyps* (fig. 1 *a*, fig. 10, and fig. 13 *a*). I can scarcely express the surprise I felt on discovering these remarkable organs. I was examining a specimen of *Hydractinia*, from which the crab had been removed, when I found a number of bodies, like small white snakes, closely coiled in one, two, or three spirals, and grouped immediately round the mouth of the shell (fig. 13 *a*). These bodies, when touched, only drew their folds more closely together. But if any part of the polypary, however distant from them, was irritated, the spiral polyps uncoiled, extended, and lashed themselves violently backwards and forwards, and then quickly rolled themselves up again; and that not irregularly or independently of each other, but all together, and in the same direction, as if moved by a single spring. A violent laceration of the polypary caused these polyps to remain extended and stretched like a waving and tremulous fringe across the mouth of the shell for several minutes. The Ophidian Polyps (evidently a barren modification of the reproductive polyp) are never found in any other situation on the polypary than in that before described, or round the margins of accidental holes in the shell. They have no mouth, and the tentacles are rudimentary. The walls of the body are very transparent, from the extreme vacuolation of the endoderm. The muscular coat, as might be expected from the active movements of the polyps, is highly developed, and forms a beautiful object on the dark polarized field of the microscope, each spiral coil shining out as a bright double ring, divided by four dark sectors. The ectoderm of the whole body and tentacles is crowded with the larger thread-cells. The ophidian polyps are, I doubt not, organs of de-

fence or offence, like the motile spines and bird's-head processes of the Polyzoa, or the pedicellariae of the Echinodermata; but I am unable to assign a reason for their peculiar situation. They vary much in number and size in different specimens of *Hydractinia*, but are rarely altogether absent.

31. *The Tentacular Polyp*—(fig. 1 *e*, and fig. 13 *b*).—Not less surprising than the polyps last described are these, the great tentacles of the polypary. When a specimen of *Hydractinia* is allowed to rest suspended in a glass jar of water, these organs are extended to a distance of three, four, or even five times the length of the alimentary polyps, and hang down, loosely floating in the water, like the thread-like tentacles of the long-armed hydra. They are found on the outskirts of the polypary, and on each side of the long diameter of the mouth of the shell, so that they must, in their natural condition, reach to the ground, and enable the zoophyte to seize food scattered there by the feeding crab. The tips are covered with a dense pavement of the larger thread-cells; and a few of the same bodies are thinly scattered along their whole length. As far as I know, no organ analogous to them exists in any other hydroid zoophyte. They have not been hitherto described.

32. In our consideration of the subject of this communication our attention is arrested by the multitude of objects grouped together to constitute a single animal, their variety in form, and the sympathy which subsists between the different parts. The singular spinous skeleton; the expanded membrane of the polypary, with its beautiful internal network of tubes and delicate peripheric prolongations; the alimentary polyps, some white and filiform, others thick, fleshy, crimson, or yellow sacs, obligingly everted, to expose their interior to our microscopic eye; the reproductive polyps, with their richly-coloured generative sacs; the sessile generative organs of the polypary; the ophidian polyps, coiled in neat spirals when at rest, but starting into furious action, like a row of well-drilled soldiers, when injury is inflicted on the body to which they are attached; and lastly, the tentacular polyps, floating in the water like long and slender threads of gossamer, or dragging up heavy loads of food for the common good; these, together with the intimate relation and sympathy subsisting between the

polypary and its associated organs; all combine to form an object of the highest interest, and indicate that in this fixed, yet travelling zoophyte we have a type of structure transitional between the dendritic hydroïdæ and the more highly organized acaleph. In the simplest acalephoid form, such as the medusoid of *Campanularia* (which is nothing more than an extension of the polypary specially organized for independent and motile life), we have (as in *Hydractinia*) an expanded polypary, represented by the umbrella, and permeated by vascular tubes, from the confluence of which last spring, *at the centre*, the single alimentary polyp; *at the periphery* the tentacular polyps, various in number; and between them the reproductive polyps, represented by the sessile generative sacs. In the higher Rhizostomes we find, as pointed out by Huxley, a multitude of alimentary and reproductive organs, united by ramifying tubes, which permeate a massive swimming polypary. In other acalephæ, such as *Velella*, *Porpita* and *Ratraria*, we probably have a still closer resemblance to *Hydractinia*, in the development of a corallum, represented by a horny plate, which in the last of these medusæ elevates the crest, serving as a sail by which the floating mass is propelled before the wind along the surface of the waves.

33. In conclusion, I must mention that *Hydractinia* is infested by a small species of *Eolis* (*Eolis nana*), which peels off the polypary with its rasp-like tongue, and devours it,—possessed, I suppose, of some potent magic, which renders all the formidable armament of its prey of no avail. Now, each of the dorsal papillæ of the *Eolidæ* contains at its extremity a small ovate vesicle, communicating, through the biliary sac, with the digestive system, and opening externally by a minute aperture at the end of the papillæ. This vesicle is found crowded with compact masses of thread-cells; which masses, in *Eolis nana*, consist of aggregations of small and large thread-cells, identical in size and shape with those of *Hydractinia*,—on which this *Eolis* preys—not contained in capsules, but cemented together by mucus. When we consider that each of the vesicles is in indirect communication with the stomach, I think we may, without presumption, suggest a probability that the masses of thread-cells found in *Eolis nana* are quasi faecal collections of

the thread-cells of *Hydractinia*, which, protected by their strong coats, have escaped the digestive process. In corroboration of this view, I may mention that the thread-cells of *Eolis papillosa*, as figured in the work of Alder and Hancock, have a perfect resemblance to those found in the Actinias, which last animals furnish an Abyssinian repast to these carnivorous mollusca.

IV. *Descriptions of new Coleoptera from the Western Andes and the neighbourhood of Quito.* By ANDREW MURRAY. (Plate X.)

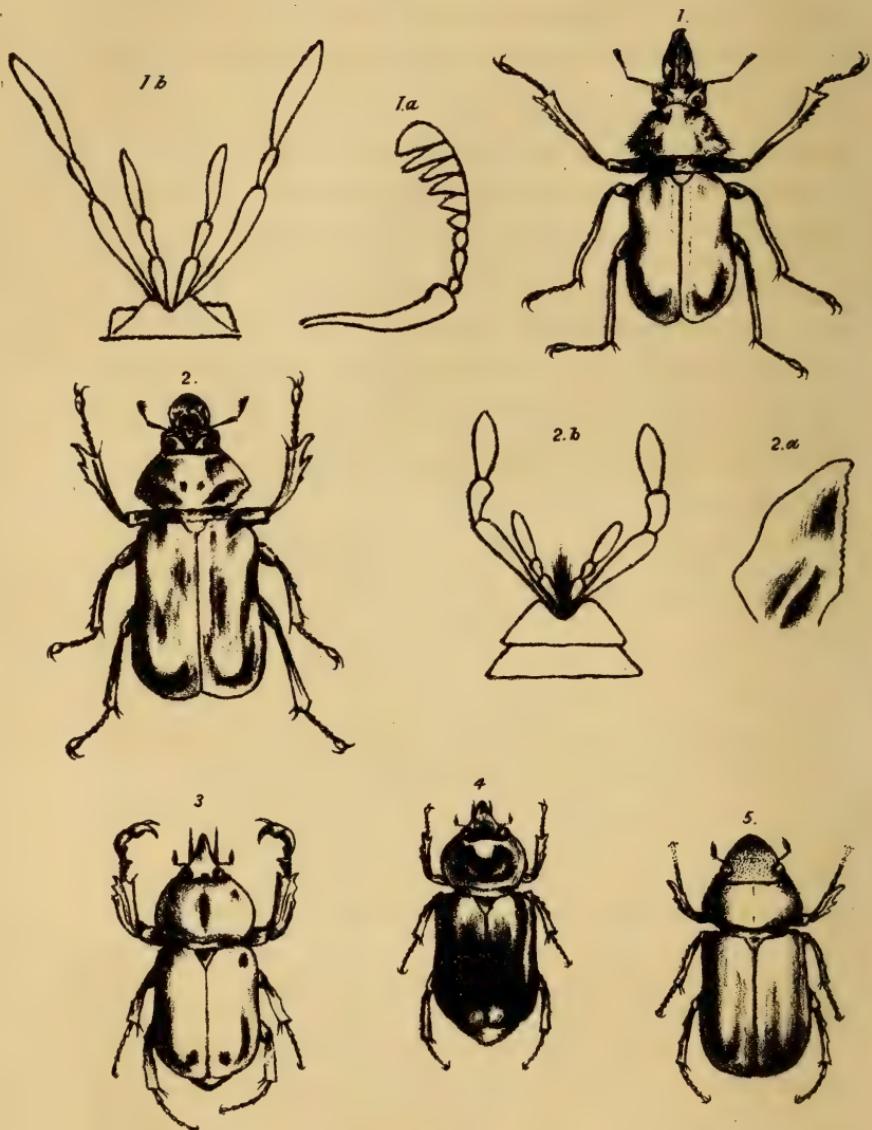
PART I.

Most of the Members of the Society must be familiar with the name and reputation of Professor Jameson of Quito, from the notices which have appeared, in various journals, of the collections he has sent home, and of the new or rare species of plants and animals which he has discovered. The Professor seems to be one of those rarely-gifted individuals whose genius embraces every branch of science. It enables him, while ably discharging his duties as professor of chemistry in Quito, and officially superintending the Mint of the State, also to explore the unknown regions of the country he lives in, and to contribute stores of information, and valuable collections in every department of Natural History, to the scientific world in Europe. In illustration of this, it will be enough to refer to the extensive botanical collections transmitted by him to Professor Balfour and the University of Edinburgh, and to the orchids supplied to Professor Lindley of London; to the numerous new and beautiful plants which have been raised by the well-known successful cultivator and hybridizer, Mr Isaac Anderson of Edinburgh, from seeds sent to him by Professor Jameson; to the mud-gatherings for diatomaceæ which have been communicated to Dr Greville; and to the new or interesting birds sent to Sir William Jardine and Mr Gould. I also have been fortunate enough to participate in the treasures which Professor Jameson periodically lavishes upon his friends and correspondents in this country, and have at various times received collections of insects made by him during his excursions among the Upper Andes. The principal portion of

the insects which have come into my hands have been Coleoptera; and among them, besides many already known, which are noteworthy, from their geographical distribution and affinities, there are also several new and interesting species, which I purpose to describe in the following pages.

The most striking of these are not from the country immediately around Quito (which Professor Jameson informs me is not rich in insects), but from the warm and wooded valleys of the Andes, where nature smiles and puts on her gayest attire.

As might be expected from its position (occupying as it does nearly a middle place between the countries on the east and west of the Andes), the district in question furnishes not only species peculiar to itself, but also others properly belonging to the countries lying on each side of it. A considerable proportion of those which I have received are species already familiar to entomologists, as inhabiting the large tract of country formerly known under the name of Columbia, now broken up into several smaller states. Among the most striking of these I may mention;—*Pseudoxycleila bipustulata*, *Sterculia fulgens*, *Philonthus flavipennis*, and *dives*, the rare *Latona spinolæ*, and *Conotelus vicinus*, *Oxysternon conspicillatum*, *Hoplites Pan*, the magnificent *Chrysophora chrysochlora*, *Lasiocala fulvohirta*, &c. &c. Of the species already known as inhabiting the Peruvian side of the mountains, the numbers have been fewer, the most striking being the curious *Golofa Eacus*, *Cybister laevigatus*, *Scarites auriculatus*, &c. Besides these, there are a considerable number of species, differing from any known to inhabit the adjacent countries. Some of these, such as *Ancognatha Scarabæoides*, Erichs., *Heterogomphus Bourcieri*, Guer., &c., have been already described, but the most of them still remain unknown. I shall endeavour to reduce the number of these, by publishing from time to time descriptions of some of the species which I have already received, or may in future receive, from Professor Jameson. This mode of recording them will necessarily render it impossible to follow out any determinate arrangement. I shall therefore not attempt any, but shall merely take them as they come to my hands.



1. <i>Sphaenognathus Lindenii</i>	3. <i>Ancognatha Crassimanaus</i>
2. <i>Do.</i>	4. <i>Do.</i> <i>Jamesoni</i>
5. <i>Leucothyreus gigas</i> .	

SPHENOGNATHUS, Buq.

This genus, which was originally erected by Buquet (after Dejean), *Rev. Zool.* 1838, possesses much interest, as being one of the links which connect the New Holland *Lamprimæ* with the South American *Chiasognathi* and *Pholidoti*.

The only species which have yet been described are *Sphenognathus Prionoides*, Buq. ; *Sph. albofuscus*, Blanch ; and *Sph. Feisthamelii*, Guer. The former, which was first described, comes from Columbia, and approaches most nearly to the new species which I am about to describe.

This is already known in collections under the MS. name of *Sph. Lindenii* ; that name having been bestowed upon it by the Parisian entomologists, to some of whom I supplied it when I first received it from Professor Jameson. This name I have retained.

1. *Sph. Lindenii*, Murr. (Pl. X. ; male, fig. 1 ; female, fig. 2.)

Mas.—*Statura Sph. Prionoides* sed postice parum latior et mandibulis longioribus. *Castaneus*, supra æneo-virescens, mandibulis elongatis, porrectis, deflexis et apice recurvatis, plus quam duplo longioribus capite ; oculis cantho divisis ; thorace et capite longa pubescens fulva vestitis, tibiis mediis et posterioribus fere simplicibus. *Long.* 15 lin., *lat.* 7 lin.

Femina.—*Thorace transverso parce pubescente, angulis posticis virescentibus, corpore subtus cinereo-fulva pubescens vestito. Mandibulis curtis, obtuse rotundatis, longitudine capitidis; tibiis posterioribus, fere simplicibus. Long. 17 lin., lat. 8 lin.*

Male.—Of the form of *Sph. Prionoides*, but broader behind, and with the mandibles longer. Reddish chestnut brown ; thorax and head darker than elytra ; in certain lights the upper surface (except the mandibles) has a faint greenish brassy reflection, which is most marked on the elytra ; head and thorax, and under side, clothed with a long fulvous pubescence, which disappears on the disk of the thorax. Mandibles porrected, rather more than twice the length of the head, bent downwards about one-third of their length from the base, and slightly reflexed and incurved at the apex

(which terminates in a curved tooth), with a ridge running along their upper side, interrupted or bent about one-third from the base; coarsely punctate or granulated on the upper side; smooth and more finely punctate, and with much more pubescence on the under side, particularly towards the base. A row of small teeth on the inner side of each mandible. Palpi dark brown; maxillary palpi longish. Antennæ 10-jointed—first joint long; second, third, and fourth, short and round (third longest of the three); six last lamellar, gradually increasing to the ninth, which has the longest lamella. They do not differ from the antennæ of *Sph. Prionoides*, unless in that they are comparatively thicker, and the lamella of the ninth joint is perhaps more certainly longer than the tenth, while in *Prionoides* they are so nearly alike as to make it difficult to say that the ninth is longest. Eyes divided by a canthus, into a superior and inferior eye; a ridge surrounding the upper half of the eye like a circular eyebrow. Thorax coarsely punctate, except on disk, where it is more sparingly punctate, and has one or two prominences, shining and almost free from punctures. A large longitudinal depression occurs on each side in front behind the eyes, and an oblong transverse space is partitioned off, as it were, at each of the posterior angles, by two depressions, which join each other nearly at right angles. There is a faint indication of a longitudinal dorsal line. In front the thorax is of the breadth of the head, and gradually becomes wider till about one-third of its length from the base, when it turns and slopes off more abruptly in a sinuated line towards the base, which is slightly emarginate. The pubescence, combined with the slight cutting in on each side of the body, give the appearance of a tooth projecting there a little backwards. The space between the thorax and elytra, which in all the species of this genus is rather broad, is covered with a pubescence similar to that on the thorax, as is the scutellum, which is large, and nearly semicircular. Elytra polished and shining, and free from pubescence, covered with very minute punctures, not perceptible to the naked eye, which in many places run into each other, and give a sort of granular or shagreened appearance under the lens. Besides these, there are larger punctures or depressions irregularly scattered over the

elytra, in places showing a slight tendency to run in rows. There are also a few shallow longitudinal depressions, which may be viewed as evanescent striæ. They are slightly depressed around the scutellum. The shoulders, and an elevation or haunch near the outer margin, towards the apex, are prominent. The elytra are expanded a little for the posterior half, and each is rounded in a little towards the suture ; a distinct marginal line or thread, reflexed towards the base, goes round the elytra. Legs light, reddish chestnut-brown ; tarsi long, and dark brown ; anterior tibiæ long, flattened, incurved, obtusely denticulated on the outer margin ; middle tibiæ with two or three very small teeth ; posterior tibiæ with scarcely perceptible indications of denticulation.

The differences between the male of this species and that of *S. Prionoides*, are the following, viz. :—The mandibles in the former are nearly twice as long as in the latter, and are closer set together ; the bend or interruption in the ridge on their upper side takes place one-third from their base, while in *Prionoides* it is at one-third from their apex ; and in the latter the ridge runs nearly straight to the head for the posterior half, while in the former it is curved for the short distance it has to go after the bend. The maxillary palpi here are comparatively longer. The thorax is somewhat differently shaped ; it tapers towards the front more rapidly in this species. The punctuation is closer and deeper in *Prionoides* ; the pubescence in it is cinereous ; in this it is russet, or fulvous yellow ; it is also in greater abundance here. The æneous lustre on this species is very distinct, while in *Prionoides* it is either wanting or scarcely perceptible. The elytra in this expand distinctly behind ; in *Prionoides* the sides are more parallel to each other ; in the latter the anterior tibiæ are narrower, and the teeth on the outer margin sharper and more developed ; on the middle and posterior tibiæ the small teeth are distinct ; whilst in this species they are either wanting or scarcely perceptible.

Female.—Larger and broader than *Sph. Prionoides*, and with differently-formed mandibles ; dark chestnut ; the posterior angles of the thorax virescent, the rest of the body without any brassy or green lustre ; under-side covered with a dull

fulvous pubescence, which occurs also sparingly on the thorax. Head coarsely granular, with a transverse ridge having a granular elevation on each side in front, a somewhat triangular granular elevation extending backwards behind this. Mandibles short, like those of the female of *Chiasognathus Grantii*, and obtusely rounded, not longer than the head; inner side straight, denticulated, fitting to opposite mandible; outer margin raised, so that when the mandibles are closed they have the form of a shallow cup; their upper side is coarsely granular, lower side rounded, punctate, and pubescent; an oblique sharp ridge extends along the posterior half of the upper side. Eyes as in the male. The antennæ and palpi are comparatively shorter and thicker than in the male. Thorax transverse, and of a similar form, but not sloping so rapidly back to the projecting posterior angle, making the whole thorax broader and larger. A large depression on each side in front, between the eyes, and large depressions in each of the posterior angles, leaving a smooth elevated figure, of the shape of a widely expanded V, on the disk, which shows indications of a dorsal longitudinal line; deeply and densely punctured on the sides; more sparsely, but still deeply, on the disk, which is polished. Elytra long and broad, somewhat expanded behind, wholly covered with minute punctures, scarcely visible to the naked eye, but coarser than in the male; also covered with larger corrugations, mostly running transversely, and some of which exhibit a tendency to longitudinal striation. The tibiæ are a good deal shorter than in the other species. The anterior tibiæ are broader, and the last two teeth are larger and more prominent. The middle tibiæ are denticulated, one tooth at least being sharp and prominent. The posterior tibiæ are almost simple, the denticulations doing little more than roughening their edge.

The above two insects are the only species of this genus which I have received, and as the one form is that of a male and the other that of a female, I assume them to be male and female of the same species. Perhaps this is jumping a little too rapidly to a conclusion; but they do not differ more from each other than the sexes of the other species do; and the fact that I have received considerable numbers of each, and never

any other male or any other female form, induces me to think that I am right in classing them together.

PHANÆUS, M'Leay.

1. *Ph. velutinus*, Murr.

Mas.—*Niger, opacus, sericeo-opalino-velutinus*; thoracis lateribus, pygidio et femoribus subtus, rubro-cupreis; elytris leviter striatis; subtus minus opacus. Long. 8 lin., lat $5\frac{1}{4}$ lin.

Male.—Deep black, opaque, with silky velvety opaline reflexions. Head with a nearly straight horn, very slightly bent back, scarcely longer than height of thorax; front and sides of head transversely strigosely granulated. Thorax excavated in front, and with two tubercles in the middle, projecting over the hollow, much broader and deeper in front than behind, the anterior angles projecting a little, and slightly reflexed; a narrow irregular space along the margins, of a rich dull red metallic copper colour, which also extends over the reflexed margin at the side of the posterior angles of thorax. There are two shallow depressions at the base of the thorax in front of the scutellar space. No scutellum. Elytra contracted at the base, margined with a raised line and reflexed margin, faintly striated; the striæ dull and impunctate, and each ending in a fovea at the base. Pygidium very faintly and sparingly punctate, opaque, of the same rich dull red metallic copper colour as the margin of the thorax; as also are the under sides of the thighs. Under side less opaque than upper; mesosternum not produced, nearly diamond shaped; anterior point of it a little pinched in, and with a slight depression behind it; anterior tibiæ, with two teeth and a sinuation, besides the terminal tooth.

One of the smallest species of *Phanæus*. A single male specimen is all that I have seen.

CHLOROTA, Burm.

1. *Ch. lineata*, Murr.

Statura Euchloræ viridis, sed magis elongata et postice latior; nitens, viridis, levissime punctata; elytris viridibus cum tinctura testacea translucenti disposita in vittis; meso-

sterno fortiter projiciente; uno ex unguicululis anterioribus bifido, unguiculis ceteris simplicibus; subtus roseo-cupreoviridi. Long. 12 lin., lat. 6 lin.

Nearly of the same form as *Euchlora viridis*, but a little more elongate, and the elytra a little expanded behind; bright green, polished, shining, exceedingly faintly, irregularly punctate. Head with a few scattered, nearly imperceptible punctures on the forehead, deeply and closely punctate along the clypeus; a black line like a crack starts from a corner in front of the canthus of the eye, and after a short distance breaks into two branches, which soon disappear; as in the rest of the genus, a short canthus half separates the eye into two. Labium emarginate. Thorax bright green, with a faint testaceous tint shining through here and there; very smooth on the disk, but a few small scattered punctures may be seen by the aid of a lens, and these are more numerous and visible (although still very faint and sparse) along the sides. The punctures are nearly uniform in size,—not large and small mixed together; a marginal stria runs along the sides, not reaching wholly to the basal margin, is continued round in front of the anterior angles, but disappears immediately after; no marginal stria along any part of the base. Scutellum elongate, very smooth, nearly impunctate; the apex and margins next to it black. Elytra green, with a testaceous tinge shining through it, which is disposed in longitudinal stripes,—in my specimen there are three such stripes visible on each elytron,—polished and shining, with scattered minute longitudinal punctures, disposed somewhat in rows, not visible to the naked eye. There are several impressions, like effaced striæ, and a few larger punctures, disposed irregularly along the margin near the base, like a marginal stria. Pygidium bright green, with a bronzy hue in some lights; irregularly transversely strigose. Under side and legs rich rosy copper, with the middle of the breast and basal portion of abdominal segments bronzy green; prosternum, sides of breast, and edges of thighs, thickly clothed with a fulvous pubescence; abdominal segments, except the last, strigosely punctate, with occasional hairs springing from the punctures, which are arranged chiefly in an irregular line, parallel with

margins of the segments ; last segment smooth and impunctate, except on the margins. Mesosternum produced into a strong recumbent spike, recurved at the apex ; sides of breast obliquely strigose ; middle, impunctate behind, but punctate in front ; the punctures (from most of which a hair proceeds) extending up the mesosternal projection to nearly the point where the punctuation is abruptly terminated by a fine rounded line ; a black suture runs down the middle of the mesosternum, with a branch projecting from each side, near the middle like an arrow-head. One of the anterior claws of the only specimen I have received is bifid, while the middle and posterior tarsi have both claws simple, thus showing that my specimen is a male.

It is possible that the testaceous tinge seen shining through the green in this species, and forming stripes on the elytra, from which I have given it its name, may appear more or less distinct, according to the maturity of the insect. Having received only one specimen, I cannot say as to this ; but my specimen seems in all respects fully matured.

2. *Ch. Euchloroides*, Murr.

Statura fere *Euchloræ grandis*, et colore, et facie superna, simillima. Polita, nitida, viridis, punctata, punctis majoribus et minoribus intermixtis ; scutello grandi ; mesosterno fortiter projiciente. Long. 13 lin., lat. 8 lin.

Nearly of the form of, and exceedingly resembling, *Euchlora grandis*, in colour and facies. Green, shining, and polished. Head finely and densely punctate, particularly in front. Thorax densely and finely punctate ; the interstices between the punctures filled with a still finer punctuation, and both crowded together into a kind of granulation on the sides of the thorax. There is a marginal line and raised margin along the sides, which disappears after turning the anterior angles, and scarcely turns the posterior. The raised margin is more or less testaceous, sometimes quite yellow, and sometimes green, with a yellow tinge shining through. Scutellum large, longer than broad ; the apex and adjacent margins black ; very faintly punctate. Elytra green, with reflexed margin, which is more or less yellow, or green, tinged with

yellow shining through ; punctate, the punctures as if made from behind, some disposed in striæ, of which depressed traces are seen. Under side and legs green, with a faint coppery tinge in certain lights, particularly along the margins of the segments of the abdomen ; pubescence on posterior sides of breast and edges of thighs not so dense as in preceding species ; mesosternal projection and middle of breast with nearly the same markings as last species, but stouter and not punctate. I have only received female specimens with the tarsi perfect. They have the exterior claw in each tarsus bifurcate, as is the character of the claws of the female in this genus.

LEUCOTHYREUS.

1. *L. Gigas*, Murr. (Pl. X., fig. 5)

Supra castaneo-cuprescens, glaber ; antennis articulis decem, castaneis, clava rufa ; capite magno, grosse denseque punctato-rugoso ; prothorace fortiter punctato, lateribus grosse punctatis-rugosis, marginibus denticulatis ; scutello punctato ; elytris inequalibus, lineis lœviter elevatis signatis, humeris et spatio prope apicem prominentibus, lœviter punctatis, punctis minoribus et majoribus interspersis ; subtus cuprescens, sparsim fulvo pubescens ; pygidio punctato. Long. 14 lin., lat. $5\frac{1}{2}$ -6 lin.

Oblong, and rather depressed ; dark, dull, coppery, reddish chocolate-brown, with dull reddish metallic lustre in parts, especially on the head and thorax, and thighs and abdomen ; glabrous above. Head very large and broad, rounded in front, very deeply, thickly, and coarsely punctate ; the clypeus chocolate brown, separated from the forehead by a faint suture ; the forehead dull, coppery, reddish brown. Antennæ 10-jointed, chestnut-brown ; club, pale and reddish. Eyes large, but not prominent ; a short canthus encroaches on the anterior half. Labrum large, declive, projecting in front, foveolate ; slightly metallic, and with some scattered fulvous hairs. Thorax short and broad, bisinuated behind, deeply emarginate in front ; anterior angles prominent and acute, widest a little behind the middle ; whole surface covered with large punctures, less deeply impressed on the disk, but very deep, coarse, and rugose on the sides, extending to and upon the raised lateral margin, which appears irregularly denticulate,

as if from the large punctures having pierced through the edge and left circular breaks in its continuity. This raised margin is distinct and well marked on the sides, and extends along the base, but is wanting in front. The basal raised margin is virescent; there is the trace of a dorsal smooth ridge most distinct in front. The scutellum is dull metallic red, with virescent margins; it is triangular, with the apex rounded, and is distinctly punctate, though not so coarsely or deeply as the head and thorax; a faint irregular impunctate raised line passes down the middle. The elytra are smoother, particularly on the disk; but are so closely covered with minute punctures as to have something of an opaque appearance. Besides these minute punctures, there are others of various larger sizes scattered among them; and a third class of still larger punctures is also to be seen, which have a tendency to run in striæ. The whole of these punctures, however, are very shallow, and have no resemblance to the deep punctures on the head and thorax. They are most deeply impressed about the base of the elytra. The disk is flattish, the shoulders are prominent, and a sort of ridge connects them with an apicul prominence, the sides falling rapidly down on each side, and expanding somewhat behind; the wings are long and brownish. Pygidium finely punctate—most closely and finely at base. The under side is of the same colour as the upper; the abdomen and thighs are smoother and more shining. Prosternum, and especially mesosternum, clothed with longish fulvous pubescence; mesosternum coarsely punctate; segments of abdomen more faintly and sparingly punctate; punctures deepest along the margin of the segment; legs coppery, dark reddish brown, with faint metallic lustre; anterior tibiæ with three teeth; tarsa moderate in length, and slightly thickened. In the only specimen I have received the middle tarsi have the outer claw bifid, and the posterior tarsi the claws simple;—the anterior claws have been broken off.

ANCOGNATHA, Erich.*

1. *A. Jamesoni*, Murr. (Pl. X., fig. 4.)

Testacea, nitida; vertice, pronoti disco, elytrorum disco et

* Notwithstanding the high authority of Professer Lacordaire (Hist. des Ins.

margine plus minusve nigris vel piceo-nigris ; pronoto elytris augustiore ; scutello lævissime punctato ; elytris geminato-punctato-striatis, postice parum dilatis ; geniculis, tibiis extus et tarsis plus minusve piceis. Long. 12 lin., lat 6 lin.

Testaceous, more or less clouded, or marked with black, or piceous black. Head conically produced, and recurved like a sow's snout ; rugosely punctate, the edges and front with a reflexed black margin ; two tubercles, united by a curved ridge between the eyes, making a slight separation between the front and back of the head ; these tubercles and ridges, the vertex and the reflexed margins of the head, are all more or less distinctly marked with black or dark brown. Mandibles black, protruding, tapering, recurved ; but not reaching so far as the end of the snout. Palpi and antennæ blackish-brown ; antennæ with ten joints. Thorax, with two or three depressions or irregularities in the surface on each side of the disk ; more or less clouded with black or dark brown, often inclosing two testaceous spaces on the disk ; smooth and shiningsparingly punctate, at its widest narrower than the elytra ; when seen in profile, not rising in a curve from the base, but proceeding straight forward, and rounding down towards the apex ; margin with a raised edging along the sides in front and a short part of the base, next the angles, but not on the middle of the base, which is slightly bisinuate ; sides rounded, slightly oblique behind, widest a little before the middle, rapidly contracted in front ; anterior angles slightly projecting ; posterior angles rounded. Scutellum triangular ; lateral sides very slightly sinuate ; sparingly and faintly punctate ; testaceous, with a larger or smaller black or dark patch, which is more or less interrupted with testaceous. Elytra shining, of rather a coarse texture, more or less clouded with black, the extent of the black varying much. The testaceous portions are usually a space around the scutellum, extending a short distance along the suture and along the base, sending down for a short distance about the middle an arm parallel to

iii., 399), who disallows this genus, and retains it as a portion of the Genus *Cyclocephala*, I agree with Erichson in holding that the characters he has given, more especially the recurved mandibles, are sufficient to justify its being retained as a distinct genus, although they may not be of equal value with those of the great genus from which he has separated it.

the suture, then to the shoulder, after rounding which, at the very base, it turns down and sends an elongated stripe, parallel, or nearly so, to the exterior margins, sometimes continuing more or less distinctly round the whole elytron, till it reaches the suture near the apex, where there is almost always a testaceous patch on each side of the suture. The sides of the elytra are not quite parallel, being a little expanded behind the middle. Each elytron is deeply punctate striate, as follows, viz.,—a single regular row of punctures runs next the suture, then follows a space with two or three irregular rows, then two regular rows, then two or three irregular rows, then two regular rows, two or three irregular rows, two regular rows, and the remainder irregular rows. Margin with a reflexed border, which is expanded about the middle of the elytron. Pygidium testaceous, rather large, smooth and impunctate; upper side of penultimate segment of abdomen finely punctate. Under side of body wholly testaceous; mesosternum clothed with long fulvous hairs; prosternum less hairy, and abdomen with only a few hairs along the margins of the segments, where, as well as on the sides, there are a few punctures. Legs testaceous, with a tinge of piceous or brown at the knees, and along the outer margin of the tibiæ; the anterior tibiæ have three teeth. The tarsi wholly piceous, long and slender. The claws simple, and of equal proportions.

This species bears considerable resemblance to *A. ustulata* (Dej.), Burm. Its system of coloration is the same, and its general form is also very near it; but it is larger, of a coarser texture, and has the head and thorax punctate, and the elytra punctate and geminato-punctate striate; whereas in *ustulata*, the head and thorax are smooth and impunctate, and elytra only very faintly punctate.

I have received many specimens of this species from Professor Jameson, in honour of whom I have named it, but I do not find in any of them the thickening of the anterior tarsi, usually seen in the males in this genus. It may be that they are all females, but I have not been able to ascertain this by dissection, in consequence of the interior of the insects having been eaten away by larvæ on their way home.

2. *A. crassimanus*, Murr. (Pl. X., fig. 3.)

Præcedenti valde affinis, sed major et robustior, capite et mandibulis grandioribus; thorace latiore, latitudine elytris equali; scutello fortiter strigoso-punctato; elytris fere parallelis, vix postice dilatatis; pedibus anterioribus valde incrassatis. Colore testaceo, thorace macula oblonga dorsali, et duabus parvis maculis rotundatis in angulis anterioribus piceis signato; elytris maculis parvis humeralibus et apicalibus piceis signatis. Long. $13\frac{1}{2}$ lin., lat. 6 lin.

Closely allied to the preceding species. Testaceous, with the back part of the head, a dorsal elongate patch and two faint spots in the anterior angles of the thorax, a patch at the base of the scutellum, the sutural line and the exterior margin, as well as a humeral and apical spot in each elytron, piceous or blackish-brown. Head finely rugosely punctate, projecting very much, and turned up like a sow's snout; the margins with a reflexed black border; the mandibles projecting forward, and recurved like a boar's tusks, extending a third of their length beyond the muzzle; a curved transverse depression between the eyes. The back part of the head marked with a transverse line of black, widest in the middle. Thorax, very convex when seen in profile, rising with a curve both from the base and apex, widest a little before the middle, broader at its widest than the elytra; anterior angles acute and produced; posterior angles obtuse and rounded; base bisinuate. It has a reflexed piceous margin all round, most distinct on the sides, which are so much expanded and reflexed as to leave a small gutter between the edge and the body of the thorax; is covered with scattered shallow punctures, and somewhat granular towards the sides. Scutellum rounded; triangular, granular, or rugosely punctate at the apex; smooth behind. Elytra with the sides nearly parallel, and scarcely dilated behind the middle; with a reflexed margin, most prominent in the middle; punctate striate, the striae running in pairs, and the interstices irregularly punctured, as in the last species. Pygidium with some longitudinal corrugations. Under side of body testaceous with a testaceous pubescence, principally on the mesosternum. The anterior legs are very much

thickened, and the tarsi, and more especially the last joint and claws, greatly developed. The anterior tibiæ have three teeth; the middle and posterior thighs and tibiæ are robust, but the tarsi are long and slender. The outer claw of the anterior tarsi is much larger than the inner. The middle and posterior claws are simple, and of equal proportions.

Although this species is very closely allied to the preceding,—so much so as to suggest the idea of its being its male,—I find so many points of difference which I cannot consider sexual, that I am satisfied it belongs to a distinct species. Putting aside the difference in colour, which may be ascribed to the score of variation, the much more developed mandibles, and the immensely thickened legs and anterior tarsi, and the smaller pygidium, which may be viewed as sexual (although in no other species of the group are sexual differences developed to such an extent), we have very marked differences in the proportions and form of the head, thorax, and elytra; the head is proportionally broader and more projecting in front, and the inequalities on the surface are fewer and less marked than in *Jamesoni*; the thorax and elytra are more shining and smooth in the latter, the punctures deeper and better defined. The thorax is of a different form; in *Jamesoni* it is not nearly so convex, the curve proceeding gently and gradually from the base without any rapid or abrupt rise; while in *Crassimanus* it takes a very marked rise, both in front and behind; in the latter also it is broader than the elytra; in the former considerably narrower. The former has the anterior angles only slightly produced; the latter has them much more projecting. The reflexed margins are greatly more marked in *Crassimanus*, which also has the margin all the way round; while in *Jamesoni* it disappears on the base. The scutellum is smooth and nearly impunctate in the one; in the other it is strigosely granular. The elytra in *Crassimanus* are proportionally longer and narrower, and are nearly parallel, very slightly, if at all, dilated behind: while in *Jamesoni* the dilatation is well marked. In it the pygidium is smooth and shining; while in this species it is dull, and has a number of longitudinal grooves or striæ. These differences satisfy me that the two species are distinct.

I have only received a single specimen of this species, and its very curious greatly-developed anterior tarsi lead me to suppose that it is a male.

V. *List of Coleoptera from Old Calabar.* By ANDREW MURRAY, W.S.
(An extensive collection of insects was exhibited.)

This paper will be found in the Appendix.

The President, Mr ROBERT CHAMBERS, after expressing his admiration of the zeal and talents of Professor Jameson of Quito and the U. P. Missionaries at Old Calabar, from which the Royal Physical Society had so often profited, moved that the thanks of the Society should be conveyed to them,—a motion which was carried unanimously; and Mr Murray was requested to communicate accordingly to Professor Jameson, the Rev. Mr Waddell, Mr Goldie, and Mr Wylie.

Dr JOHN ALEX. SMITH exhibited the cranium of a red deer (*Cervus elaphus*), which showed an interesting variety in the development of its antlers; the right antler being without branches, and 13 inches in length; and the left 16½ long, with its first branch, or brow antler (as it is commonly termed, from projecting over the brow), 6½ inches long, but in this case rising from the back part of the horn, at about 2 inches from its base, and projecting backwards. The stag was believed to be of great age, and the horns may show an accidental variety depending on that cause; it was recently shot at the Doune of Rothiemurchus by Lord Alexander Russell, to whose politeness the Society was indebted for its exhibition. Dr Smith also exhibited a rabbit, taken in a trap near Carnwath, in the beginning of this month, and kindly sent to him by Mr John Dickson, gunmaker, Princes Street, from the singularity of the extreme length of the fur on the upper part of its body. The peculiarity was believed to be dependent on the rabbit being a cross with an escaped individual of the long-haired, so-called Russian breed, which are frequently kept by rabbit fanciers.

Wednesday, 24th December 1856.—W. H. LOWE, M.D., President,
in the Chair.

The Office-Bearers for the session 1856–7 were elected as follows:—

Presidents.—William H. Lowe, M.D.; J. H. Balfour, M.D., Professor of Botany, University of Edinburgh; Andrew Murray, Esq., W.S.

Council.—Robert K. Greville, LL.D.; Rev. John Fleming, D.D., Professor of Natural Science, New College, Edinburgh; William Rhind, Esq.; M. Forster Heddle, M.D.; Robert Chambers, Esq.; Thomas Strethill Wright, M.D.

Secretary.—John Alexander Smith, M.D.

Assistant Secretary.—George Lawson, Esq.

Treasurer.—William Oliphant, Esq.

Honorary Librarian.—Robert F. Logan, Esq.

Library Committee.—John L. Stewart, Esq.; Alexander Bryson, Esq.; Patrick Dalmahoy, Esq., W.S.

John Anderson, Esq., St Andrew Square, was elected a Member of the Society; and Alexander E. Mackay, M.D., R.N., a Non-Resident Member.

The meeting, instead of proceeding to business, unanimously resolved to adjourn, in token of their deep sorrow for the lamented death that morning of their distinguished Fellow, HUGH MILLER; and instructed the Secretary to make arrangements for the Society taking part in the funeral, should an opportunity be afforded of doing so.

Wednesday, 28th January 1857.—W. H. LOWE, M.D., President, in the Chair.

The SECRETARY, in reference to the instructions received at last meeting, stated he had issued cards, inviting the attendance of members of the Society at the funeral of the late Mr HUGH MILLER, on Monday the 29th December; and a very large number did accordingly join the procession on its way to the Grange Cemetery.

It was unanimously resolved that it be remitted to the Council to prepare a Memorial to Government, strongly recommending the purchase of Mr Miller's very valuable and national collection, to be added to the Museum of Natural History in the University; and as the Society understood other bodies intended moving in the same direction, it was suggested the Council should take the opportunity of also joining with them in their application to Government.

The PRESIDENT, Dr LOWE, then opened the business of the meeting with the following remarks:—

GENTLEMEN,—Although we are assembled this evening on the ordinary day of meeting, as it falls in rotation, yet you must be all aware that this meeting is in fact an adjournment of our last; and the peculiar and melancholy circumstances under which that adjournment took place must be fresh in the minds of every one of us. To dwell at any length on these circumstances at the present moment is altogether unnecessary, and I merely allude to them. But when I reflect how lately Hugh Miller held the foremost rank amongst us, how constantly he attended in this hall, and how largely and fre-

quently he contributed to our scientific meetings, I feel that to pass on to the ordinary business of the evening, without one slight tribute to his memory, or one brief word of grateful remembrance, would be little in accordance with the feelings which, I am persuaded, are now uppermost in the minds of all present. It is not indeed in the power of an individual like myself to add to the world-wide fame of the friend and fellow-member we now deplore. As long as science is cultivated will his name stand forth as a landmark, and to the just appreciation of an admiring world do I leave his reputation ; but it is as a member (alas ! how lately an active and working member) of this Society that I would think of him ; and whether we regard him as an industrious attendant of our meetings, or the one who more often contributed by his valuable papers to the reputation of our Society, he is equally entitled to that poor meed of praise which I would now endeavour, in your name, to offer to his lamented memory. My friend Dr Smith has put into my hands a list of the various papers which, during the last several years, indeed since 1848, he contributed to this Society ; and whether we regard their number, or the interesting nature of those communications themselves, I fear we shall look long, if not in vain, among our numbers for his equal and successor. I shall not, gentlemen, attempt any analysis of the valuable papers there alluded to ; most of them have been published, and all have been duly recorded in the annals of this Society ; but I think you will dwell now with peculiar interest on the remarkable words which concluded his address to us in 1854, on resigning his seat as one of our Presidents, and in which he alluded, in the following beautiful language, to the bereavement which men and philosophers had just then sustained in the death of our late beloved member Edward Forbes :—"I trusted," says he, "to have had the honour of resigning this chair to a gentleman who, fifteen years ago, was one of the most active and zealous members of the Royal Physical Society, and who had since that time achieved for himself, in natural science in general, and in geology in particular, a reputation co-extensive with the civilized world. But alas ! death reigns ! This distinguished man, in the full blow of his fame, and in the mature prime of vigorous man-

hood, has passed suddenly away ; and wherever in either hemisphere physical science is cultivated, or the bypast history of our globe excites legitimate interest, his early death will be felt and deplored as a heavy loss. The spoiler has broken abruptly off many a train of ingenious thought,—cut short many a course of sedulous inquiry,—arrested, just ere its formation, many a profound induction,—and scattered hoards of unrecorded knowledge, the adequate regathering of which many years to come may fail to witness.” How little did we think, who then listened to the delightful lecture, of which these words were the conclusion,—nay, how little did he who uttered them then think,—that in this brief period of time they would thus form his own epitaph. “ But,” again to quote his own words, “ our idle regrets can neither restore the dead nor benefit the living. Let us rather manifest our regard for our illustrious brother, taken so unexpectedly from among us, by making his disinterested devotion to science our example. Let us diligently carry on in the love of truth our not unimportant labours, remembering that much may be accomplished in comparatively brief space, if no time be lost ; and that to each and all that ‘ night cometh’ at an uncertain time, under whose dull and unbroken shadow ‘ no man can work.’ ”

The Donations to the Library were laid on the table, and thanks voted to the donors ; these included :—

1. Transactions of the Royal Society of Edinburgh, Vol. XXI., Part III., 1855-56.
2. Proceedings of the Royal Society of Edinburgh, 1855-56.—From the Royal Society of Edinburgh.
3. Proceedings of the Literary and Philosophical Society of Liverpool, No. X., 1855-56.—From the Society.
4. Report of the Commissioner of Patents for the year 1854—Agriculture : 5. Report of the Commissioner of Patents for the year 1854—Arts and Manufactures—Vol. II.—Illustrations.—From the Commissioner of Patents, U.S.A.
6. Transactions of the Michigan State Agricultural Society for 1854, Vol. VI.—From the Society.
7. List of Foreign Correspondents of the Smithsonian Institution, 1856.—Presented through the Smithsonian Institute, U.S.A.

The following communications were then read :—

I. *Observations on British Zoophytes.* By T. STRETHILL WRIGHT, M.D.,
Fellow of the Royal College of Physicians, Edinburgh.

Description of Plates XI. & XII.

Clava.

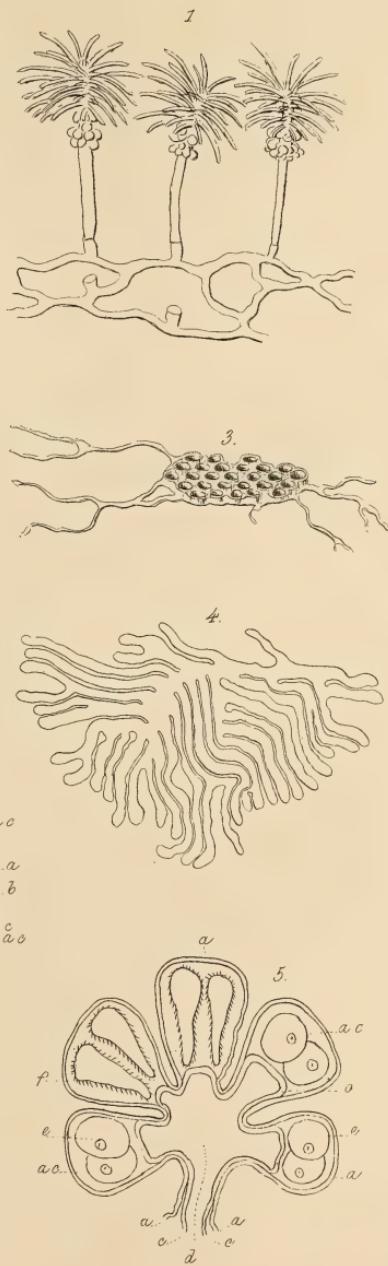
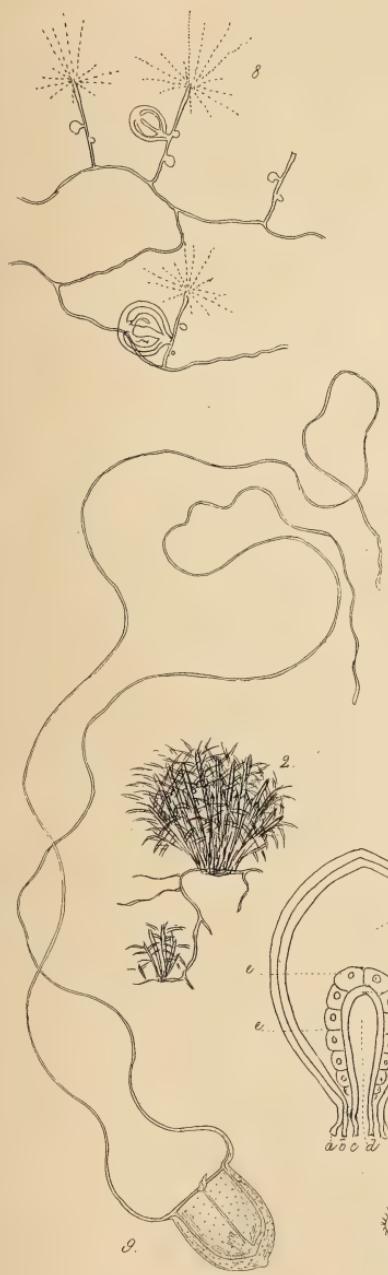
- Fig. 1. Corallum and polyps of *Clava repens* (magnified three diameters).
2. Clava membranacea (natural size).
3. Corallum or polypidom of *Clava membranacea* after removal of polyps by maceration (enlarged).
4. Portion of corallum of *Clava cornea* (from Professor Goodsir's specimen; enlarged).
5. Diagram of reproductive capsules or polyps on female polypary of Clava—*a* ectoderm—*c* endoderm—*ac* generative cavity—*d* nutritive cavity of pedicle and capsules—*e* ova changing to (*f*) ciliated planarioid larvæ.
6. Free swimming larvæ.
7. Reproductive capsule of female *Coryne glandulosa*, lettered as fig. 5, and showing the origin of the ova (*c*) from the external surface of the endoderm.

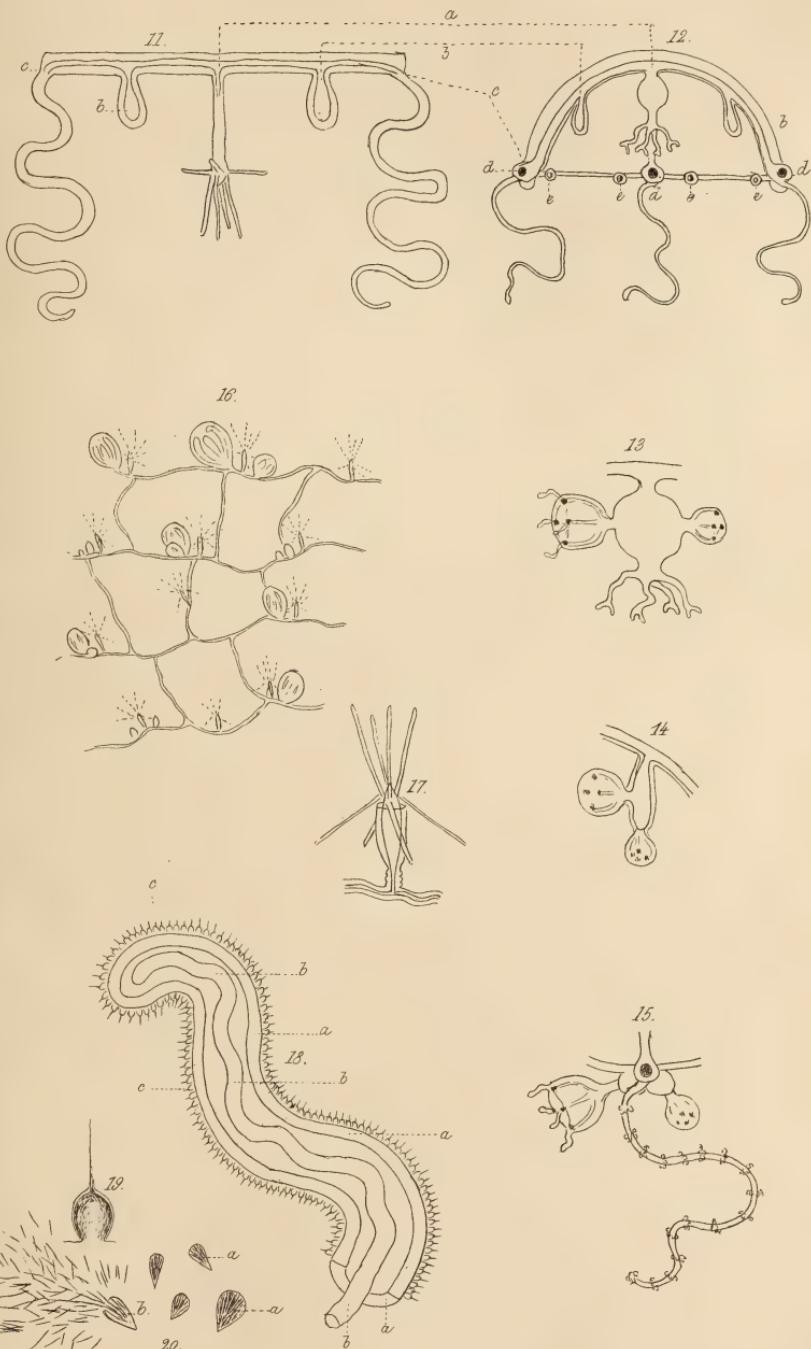
Eudendrium.

8. *Eudendrium pusillum* with Medusa-buds (eight diameters).
9. Medusoid of do., with tentacles relaxed.
- 11 & 12. Ideal figure of Hydractinia as a Gymnophthalmatous Medusa, and figure of ideal Gymnophthalmatous Medusa—*a* alimentary—*b* reproductive—and *c* tentacular organs or polyps—*d* visual, and *e* auditory organs.
13. Gemmation of Medusa from alimentary polyp.
14. Do. from reproductive polyp.
15. Do. from tentacular polyp.
16. Eudendrium sessile, with Medusa-buds (eight diameters).
17. Single polyp of do.

On Clava.

1. The genus Clava has been hitherto defined by writers on systematic Zoophytology as a single but gregarious polyp, destitute of a polypidom or corallum. Pallas, who, according to Johnston, first described this animal, writes, "Etiam hæc Tubulariis adnumerari debent Zoophytæ, quamvis ne quidem ramescent ut *Coryne*, et *tubulo corneo* plane destituta sint." Van Beneden remarks, "The individuals are not united to each other," "at least I have not seen, as in Hydractinia, a common substance which unites all the individuals." Johnston, making no mention of a corallum, says that the polyps are "single," and "fixed by a narrow disc." And the latest writer, Gosse, in his "Manual of Marine Zoology," states that the polyps are





naked, and is evidently not aware of the existence of a polypary or common connecting base between them. A similar ignorance of the existence of a polypary and corallum in *Clava* is also betrayed by Van der Hoeven in his "Handbook of Zoology." If the descriptions given by these writers were correct, *Clava* would stand alone among all the marine hydroïdæ as a naked and single polyp. One species only of this zoophyte has been hitherto described, under the names of *Clava parasitica* (Gmelin), *Hydra multicornis* (Forskal), *Coryne squamata* (Müller), and *Clava multicornis* (Johnston).

2. In a note on Dioecious Reproduction in Zoophytes, contained in the "Edinburgh New Philosophical Journal," vol. iv. p. 313,* I mentioned that I had noticed two species of *Clava*, and that the polyps were not separate, as hitherto described, but were attached together by a fleshy basis, investing a horny polypidom, somewhat similar to that of *Hydractinia*, or by a creeping thread inclosed in a membranous sheath. In the same month of July, I found a third species at South Queensferry, when examining the shore there with my friend Mr Murray. These three species I propose to designate by the names of *Clava cornea*, *Clava repens*, and *Clava membranacea*.

3. *Clava repens* (Plate XI., fig. 1) occurs plentifully on the friable sandstone of the Scougall rocks near Tantallon Castle. Its polyps are joined together by a polypary or coenosarc, a fleshy fibre inclosed in a thin tubular corallum, which creeps along, and adheres to the stone. This polypary is readily overlooked, as the "colletoderm" or glutinous envelope of its corallum is generally coated with the detritus of the rock and other foreign matters. The polyps have therefore the appearance of being solitary, and ranged in irregular lines, as shown in Van Beneden's drawing.† These polyps are about five or six lines in length, white, or coloured with tints of rose or flesh colour, and they sometimes exceed the polypary greatly in thickness. About a half line of their attached extremity is covered by a very delicate extension of the brown corallum, which remains as a cup when the polyp is removed by long

* *Ante*, p. 165.

† *Recherches sur l'Embryogénie des Tubulaires*, 1844.

maceration in fresh water. The tentacles, from four to about forty in number, according to the age of the polyp, are arranged spirally in several rows round the buccal papillæ. Thick at their insertion, they decrease in diameter towards their extremity, and are extended, with a tendency to droop at the points. Immediately beneath the lower tentacles, the reproductive capsules hang in many-pedicled clusters, so that this graceful zoophyte presents a resemblance to a miniature forest of cocoa-palms heavily laden with fruit.

4. *Clava membranacea* (Figs. 2 and 3).—In this species, found at Queensferry, the polyps are closely massed together in clusters, each cluster being either a male or female zoophyte. The animal was found adherent to fronds of *Fucus vesiculosus*, but so slightly, that the whole cluster could be readily detached by peeling it off with the point of a scalpel. The polyps had a rich aurora tint, and were larger and more slender than those of *Clava repens*, some of them being more than an inch long. The upper surface of the corallum, examined after the removal of the polyps by maceration, presented the appearance of a favoid aggregation of cells, closely cemented together by an excessive development of the "colletoderm." The cement between the cells included several species of diatomaceæ and microscopic algæ. The lower surface of the corallum consisted of a mat of parallel and anastomosing tubes of soft membrane. These tubes also passed beyond the cluster of cells which they supported, and crept along the surface of the fucus in irregular lines, to furnish, as it were, other colonies of polyps.

5. *Clava cornea* is a clustered and dioecious zoophyte, resembling in appearance the species last described. The specimen which I place on the table was kindly lent me, for this evening, by my friend Mr GoodSir, and is one of the results of his trip to the Orkneys with the late Professor Edward Forbes. The polyps are long and slender, like those of *Clava membranacea*. The corallum apparently consists of a thin chitinous plate attached to the fucus. Over part of this plate the chitine rises in low, smooth ridges, running either parallel to each other in winding lines (fig. 4), or meeting at various angles. These ridges have a double contour under the microscope.

The polypary lies between the ridges, and consists of fleshy fibres, from which the polyps spring. I believe a thin ring or cup incloses the base of each polyp, and that a membrane also passes from the summit of each ridge to that of the one next it; but I have not been able to satisfy myself on these points. In other parts of the same polypidom the ridges assume the aspect of an intricate net-work, or even a spongy mass, in which the chitinous and fleshy elements are intimately blended together. The whole mass of the polypary, corallum, and polyps, is readily detached from the fucus. [Since writing the above description, I have convinced myself, by the examination of Mr Good-sir's specimen, that the corallum of *Clava cornea* is formed of tubes cemented together, either laterally in sub-parallel lines, or in a more complicated mass. The surface of the corallum of this zoophyte, in fact, has a strong resemblance to the stem of the corallum of *Halecium halecinum*, which consists of a bundle of sub-parallel and anastomosing tubes, more or less closely cemented together, a structure which becomes beautifully apparent in transverse section.]

6. *Reproduction of Clava*.—All the three species of this zoophyte which have come under my observation are unisexual or dioecious; that is to say, the polyps connected by the same polypary have either spermsacs or ovisacs, but not both. The reproductive capsules are amassed together, like bunches of grapes, in one or more thick pedicles, which arise from beneath the lower range of tentacles of the polyp.

In my communication on *Hydractinia*,* I stated (after Allman and Huxley) that the polyps of all the hydroid zoophytes consisted of three elements:—1st, *The ectoderm or outer layer*, the seat of sensation and other external relation, furnished with tactile processes, and with apparatus of offence or defence. 2d, *The muscular or middle coat*, specialized for motor function; and, 3dly, *The endoderm or inner coat*, of which last, again, the *inner surface* is endowed with the nutritive function, while its *outer surface* subserves to that of reproduction. It is necessary to remember the relation and function of these layers when describing the reproductive apparatus of *Clava*.

* Vide *ante*, p. 192.

7. The Ovisacs of the female of this zoophyte, of which fig. 5 shows a section of five *in situ*, are found to consist of ectoderm (*a*), muscular coat, and endoderm (*c*), and their nutritive cavity is continuous with that of the pedicle, which, again, is a diverticulum of the alimentary canal of the polyp. In each of the ovisacs at an early period, one, or more generally, two transparent ova appear, consisting of a vitellus and germinative vesicle, inclosed in an envelope, and situated in the generative cavity (*ac*), between the endoderm and the other coats, as in the ovisac of *Hydractinia*. In the reproductive capsule of *Coryne glandulosa* (Dalyell) the secretion, if I may so call it, of the ova, from the outer surface of the endoderm (as shown in fig. 7), is a fact beyond doubt, but in *Hydractinia* and *Clava* their appearance takes place at so early a period of the development of the ovisac, that the seat of their origin can only be inferred from observations in other zoophytes. The ova, after becoming opaque and almost black by the granulation of the yoke, gradually assume a transparent pink tint, and are developed into ciliated planarioid larvæ, which are discharged from the distal extremity of the ovisac, and after gliding over the bottom of the vessel in which they are contained for a few days, become fixed, and changed into minute polyps. In this zoophyte the reproductive process differs from that I have described in *Hydractinia*, inasmuch as the young arrive at their larval or planarioid stage of development before leaving the ovisac, and the endodermic layer of the ovisac is gradually withdrawn into the pedicle, while in *Hydractinia* the contents of the ovary are discharged as ova, and the endodermic layer occupies the interior of the ovary to the last, although reduced in volume by absorption.

8. The Spermsacs of the male *Clava* resemble the reproductive capsules of the female in external appearance and arrangement. The development of spermatozoa in their interior is similar to that I have described as occurring in *Hydractinia*. We have the same secretion of gelatinous matter from the external surface of the endoderm; the same development in this matter of minute cells, and the production from these cells of spermatozoa. But while, in *Hydractinia*, the endoderm of the spermatic capsule is reduced, towards the last

stage of the process, to a mere line of brown granular matter occupying the axis of the capsule, in *Clava* the endoderm is gradually withdrawn from the capsule altogether, and the cavity of the latter at last contains spermatozoa alone. The spermatozoa of *Clava*, which are very large and active, are discharged from the summit of the spermsac. The ectoderm of both ovaries and spermsacs contains the larger thread-cells in great numbers.

9. The existence of spermatozoa in the reproductive capsules of *Clava*, a fact unnoticed by Johnston, was discovered by Ratke in 1844, that of ova by Rudolf Wagner in 1836, but neither of these philosophers fully recognised the dioecious character of this animal. Van Beneden also described *Clava* in 1844, and figured the male capsule, which he mistook for an entire ovum. Van der Hoeven, in his recent work already cited, rather loosely states that the propagation of this zoophyte is effected by buds which contain ova or spermatozoa, and which occasionally detach themselves from the stem on which they are developed, swim freely about, and resemble small medusæ. He gives no authority for such an opinion, and he has probably classed with *Clava* a number of small clavate polyps with filiform tentacles, such as the *Podocoryne* of Sars, the *Coryne fritillaria* of Steenstrup, and the Zoophyte described at a late meeting of this Society by Mr Peach. There also exist a number of undescribed Tubularian Zoophytes, some exceedingly minute, passing upwards through *Clava*, *Coryne*, and *Eudendrium*, to *Tubularia*, some of which give off free Medusæ.

Eudendrium.

10. The two new species of this Zoophyte I now describe can lay claim to none of the arborescent beauty which has gained for this genus the name of *Eudendrium*. So insignificant are they, indeed, that they are easily overlooked, even when carefully sought for. The first species, to which I have given the name of *Eudendrium pusillum*, is found growing on many *Sertularians* and on the back and legs of the Spider-crab, in which last situation it sometimes occurs in great profusion. It is adherent to these bodies by a creeping tubular corallum inclosing a filiform polypary. From this creeping fibre stems arise at

frequent intervals, from about one-eighth to a quarter of an inch in height, and bearing at their summit small white club-shaped polyps. The polyp is capable of partially retreating into the upper part of the tube, which is dilated at this point so as to form an imperfect cell. The filiform tentacles vary in number from four to twelve, according to the age of the polyp, and are held in two rows, the one (generally consisting of four) elevated, the other depressed or horizontal.

At almost all seasons of the year we notice *on the polyp-bearing stems* of this Zoophyte small protuberances, which rapidly increase in size, and become Medusæ or "jelly-fish" of the naked-eyed type.

The Medusa-bud first appears as a diverticulum or sac of the endodermic and ectodermic layers of the polypary, covered by an extension of the corallum. After a short period the diverticular sac becomes depressed at its summit, and at the bottom of the depression a slight elevation may be observed. This depression and elevation are the rudiments of the umbrellas and peduncle of the future medusa or acaleph. The depression rapidly deepens, until the sac becomes folded in upon itself, so as to form a deep bell with the peduncle rising like a thick clapper from the bottom of its concavity. In the mean time the endoderm of the bell (now become very opaque by the deposit of red granular matter within it) has slightly separated from the outer layer of ectoderm, and has become divided into four thick tubular lobes, communicating with each other by a circular canal at their summits, and with the peduncle at their bases, and connected together laterally by the inflected ectoderm, within which a transparent muscular membrane is developed. The ectoderm now forms the umbrella and the endodermic lobes, with their uniting membrane, form the lateral canals, and the sub-umbrella of the Acaleph or Medusa. A constant interchange of circulating particles takes place between the cavity of the parent polypary and the cavities of the peduncle and the endodermic lobes. The process of development goes on, the peduncular sac is changed into a quadrangular polyp, the endodermic lobes into slender canals, bearing at their extremities polyps of a peculiar form, systolic contractions commence in the muscular tissue of the

sub-umbrella, and the bud has become a perfect Acaleph, (fig. 9), although still joined by a narrow pedicle to the polypary of the Eudendrium. This pedicle is, however, soon absorbed, the thin covering of the corallum bursts, and the living bubble dashes away through the water, with powerful strokes, a formidable little tyrant of the sea.

When first separated from the Zoophyte, the Acaleph seeks the surface of the water with long zig-zag bounds, carrying its tentacles closely coiled in spirals. Having remained swimming there for a short time, it begins to sink slowly with the mouth of its bell uppermost, and the tentacles, uncoiling themselves, stream behind, to a distance of more than twenty times the length of the bell, in straight lines or graceful curves, sweeping the water in search of prey. In most of the naked-eyed medusæ, the umbrella is so thick and solid, that the shape of the upper part of the bell is but slightly altered by the contractions of the sub-umbrella; but in the species I am now describing the umbrella is thin and soft, so that the whole parietes of the bell contract together at each stroke, forming a curve similar to the wave-line of Scott Russell, and admirably adapted for rapid passage through the water.

A jar of these lively creatures, some swimming rapidly about like small frogs, with their half-coiled tentacles jerking backwards at each stroke, others descending headlong in flocks, like the falling train of a rocket, and all glittering under oblique illumination in the dark water, forms one of not the least interesting of those scenes of beauty which are of daily occurrence to the naturalist.

12. In the Anatomy of the Acaleph of Eudendrium four distinct parts claim our notice.

- (1.) The umbrella.
- (2.) The sub-umbrella.
- (3.) The lateral and circular canals.
- (4.) The alimentary polyp or peduncle; and
- (5.) The tentacular polyps.

13. In the description of these parts, I shall consider the animal, not as a *sexual polyp*, with Ehrenberg, Allman, Carpenter, and others, but as a free and independent extension of the *polypary* of Eudendrium; not as the product of the alternate

generation of Steenstrup, in which the parent is a zoophyte, the child an acaleph, the grandchild a polyp again, and so on in endless succession; but as a new phase in the continued development of the Zoophyte, in which the humble, fixed, and thread-like polypary attains, as it were, a higher life of beauty and motion, and an organization adapted to its changed existence.

14. At our last meeting, I described to the Society that, in the case of *Hydractinia* (a Zoophyte intermediate in its form and structure between the true Zoophyte and the Acaleph) we had a polypary consisting of a fleshy expansion permeated by a net-work of tubes, and furnished with organs of reproduction, digestion, and prehension, in the form of reproductive, alimentary, and tentacular polyps. A homologous structure obtains in the Acaleph now under our notice. Instead of a *flat expanded* polypary, we have that body bell-shaped, and represented by the umbrella, the sub-umbrella, and the lateral canals. In the peduncle, we have a single alimentary polyp. While the long tentacles, with their bulbs, form the homologues of the tentacular polyps of *Hydractinia*.

It is not, perhaps, incorrect to consider, with Allman, the ovaries and spermares of *Cordylophora*, or those of *Clava* or *Hydractinia*, as sexual polyps; but, as to the naked-eyed Acalephs, produced by gemmation from various hydroid Zoophytes, a knowledge of the anatomy of *Hydractinia* teaches us that they are something more. They are independent polyparies, having polyps endowed with various functions; some species of them possessing, indeed, differentiated organs of sight and hearing, and being capable, like *Hydractinia*, of producing other polyparies, similar to themselves, by gemmation.

In fig. 11 I have given an ideal sketch of *Hydractinia* as a *Gymnophthalmatous* Medusa, and at fig. 12, having its organs indicated by the same letters, a sketch of an ideal Acaleph or free-swimming polypary, and I have furnished this last with *the alimentary polyp* of *Lizzia* (a), *the reproductive polyps* of *Thaumantias* (b), *the tentacular polyps* of *Sarsia* (c), with their eye-specks, and the auditory capsules containing otolithes common to the Campanularian and many other Acalephs. Such an animal would be endowed with the power and special appa-

ratus for the exercise of the faculties of motion, sight, hearing, prehension, digestion, and reproduction. It will further have the power of propagating animals similar to itself by gemmation, *from its alimentary polyps*, as in *Lizzia* (fig. 13); from *its reproductive polyp*, as in *Thaumantias* (fig. 14); and *from its tentacular polyps*, as in *Sarsia* (fig. 15); and, lastly, in these budding Acalephs, even while still attached, preparation will have commenced for a still further exercise of the propagative function.

The ovaries or spermares of *Cordylophora* and *Clava* are the germens or anthers of the animal plant, while these Acalephs must be considered as the fruit-bearing branches, leading an independent life. They are the divided parts, paradoxically speaking, of an individual existence.

15. *The umbrella* (of the Acaleph of *Eudendrium pusilla*) is homologous with, and developed from, the ectoderm of the polypary. It is a clear, structureless tissue, containing, on its external surface, numerous large thread-cells, each occupying its own sac. It is continuous with the ectodermic layer of the tentacular polyps, and exists as a delicate membrane passing within the bell and partly forming the sub-umbrella, and covering the alimentary polyp.

16. *The lateral canals* (homologous with tubes of the endoderm in the fixed polypary) are situated immediately beneath, and are adherent to, the umbrella. At the summit of the bell they join together to form a quadrangular cavity, and they communicate below with a circular canal, which passes within and around the mouth of the bell. This system of canals is at first lined with red granular matter, which is afterwards absorbed, and it is constantly traversed by streams of nutritive fluid, impelled by ciliary action, and changing the direction of their course at short intervals of time.

17. *The sub-umbrella* is a thin muscular membrane attached to the exterior of the lateral canals on their inner aspect, and along their whole length, and also to the umbrella along four lines running mid-way between the canals. Its function is that of motion; it also acts as an organ of circulation and respiration by enlarging the calibre of the lateral tubes at each of its systolic contractions, and constantly refilling the bell with

freshly aerated water. Its structure has a finely dotted or crapy appearance. The dots show a tendency to arrange themselves in transverse lines during the contraction of the membrane, but no true muscular fibres exist. Numerous transparent corpuscles may also be observed scattered with some regularity in the tissue of the sub-umbrella, which, from observations in other classes of zoophytes, I am led to consider as the rudiments of a ganglionic nervous element. Similar bodies, of a fusiform shape, may also be detected along the sides and inner aspect of the lateral canals. The sub-umbrella passes across the mouth of the bell to form the veil, which is perforated in the centre by a wide circular opening. This apparatus, by contracting the jet of fluid ejected from the bell, increases its propulsive force; at the same time, by its projection outwards at each stroke of the sub-umbrella, it renders the *stern*, also, of our little vessel conical, and facilitates its passage through the water.

18. *The alimentary polyp or peduncle* (the digestive organ of the Acaleph) rises from, and communicates with, the confluence of the lateral tubes at the summit of the umbrella. In shape it is short, quadrangular, and without tentacles, differing in this respect from the Acalephs of other species of *Eudendrium* described by Dalyell and Van Beneden. Its structure consists of a layer of highly vacuolated endoderm, covered by a delicate ectodermic investment, containing a fringe of thread-cells round the mouth.

19. *The tentacular polyps* (or prehensile organs) are placed one at each confluence of the circular with the lateral canals. They consist of two parts,—the hollow bulb and the tentacle. In two of these polyps the tentacle is very short, while in the other two, opposite to each other, it is excessively developed, and, when not in use, coiled in a tight spiral. The ectoderm or outer edge of the tentacle, or that which, when coiled, forms the periphery of the spiral, is loaded with small thread-cells, while its inner edge is destitute of those bodies.

No eye-specks or otolithes can be detected in this Acaleph with the microscope, but when a taper is brought close to the side of the vessel in which it is swimming, a brilliant star of light appears at each of the bulbs of the tentacular polyps,

reflected from some tissue which I have not been able to detect.

The reproductive organs, which in the Acalephs of some zoophytes are developed before the separation from the parent polypary, have not appeared during the seven or eight days which the Acalephs of *Eudendrium pusillum* lived in my possession.

Eudendrium Sessile.

19. This species (figs. 16 and 17) is found growing on shells in deep water in the Firth of Forth, and on rocks at the shore about Granton. The red or white polyp is sessile, or united by a very short ringed stem, on a creeping polypary, and it is inclosed up to the tentacles in a membranous tube, which bends with every movement of the body. The filiform tentacles are from two to eight in number, of equal lengths, and carried in two rows, the upper one elevated, the lower one depressed. The Acaleph buds in this species are sessile, and are produced from the creeping polypary, close to each of the polyps, often in pairs. They differ in no respect of either size or form from the Acalephs of *Eudendrium pusillum* already described in this paper.

II. *Notice of Dredgings in Lamlash Bay.* By ROBERT K. GREVILLE, LL.D.

Dr GREVILLE gave a sketch of the results of the dredgings carried on in Lamlash Bay last summer, by the Rev. Dr Miles and himself, as a Committee of the British Association, and stated that they would be published in their Transactions. He laid on the table tabulated lists of marine animals taken in that locality, referring particularly to some of the more interesting species, and believed that locality to be pretty nearly worked out. He mentioned that this last season seemed, from some unknown cause, to have been generally unfavourable to the inquirers in this department of natural history, from the unusual rarity of marine animals. Dr Greville then gave some interesting details of the habits of various marine creatures, including several species of small fishes, as observed by him in a large vivarium in Arran, adding, that he believed in this way we would ultimately be enabled to acquire a very complete knowledge of the habits of many most interesting species.

III. *On the Prehensile Apparatus of Spio seticornis.* By THOMAS STRETHILL WRIGHT, M.D., &c.

Description of Plate XII.

Fig. 18. Section of tip of tentacle of *Spio seticornis*—*a*, wall of tentacle—*b*, vessel—*c*, spine-bearing papillæ.
19. Enlarged sketch of one of the papillæ.
20. Tricho-cysts—*a*, entire—*b*, ruptured, and discharging spicules.

1. Old shells taken from the sea are frequently found studded with small tubes, composed of mud and sand, cemented together by slime. These tubes are the habitation of the Annelid *Spio seticornis*. When they are placed in water, we presently see a pair of long glassy tentacles protruded from each opening, which are tossed about with such an incessant and violent motion that we are tempted to believe their concealed owners have taken leave of their senses. If a small piece of oyster is thrown amongst them, it is instantly seized by the waving arms around, and pulled hither and thither, until it is torn to pieces and devoured by the black-eyed and wicked-looking little Annelids, which, forgetting their usual coyness, protrude their heads from the tubes. We observe that the tentacles, when seizing the oyster, attach themselves to it not by winding themselves round it, but by simple adhesion, as if they were studded with numerous suckers and hooks, like the arms of the cuttle-fish. Anxious to examine their microscopic structure, we make many attempts, by rapid clips of our spring scissors, to possess ourselves of a pair of the delicate white arms, but in vain. The Spio, who has all her senses about her, twitches them in, and darts back deep into the substance of the shell, from the mouth of which her tube projects only a little distance. At last we make a successful snip, and a tentacle is placed on the stage of the microscope, still continuing its writhing motions, and gliding through the water as though possessed of independent life.

The tentacle of Spio, the tip of which is shown in fig. 18, is a hollow tube of dense granular parenchyma, covered by a thin layer of transparent tissue. Its interior is occupied by a sinuous vessel, which, in the living animal, is constantly

traversed by an ebbing and flowing tide of crimson fluid. The tentacle is thus enabled to discharge the additional function of a branchial organ, and for that purpose is furnished with a ciliated band running from the tip to the base.

The prehensile apparatus of *Spio* consists of numerous large papillæ, thickly crowded together along the borders of the tentacles. The microscopic structure of these papillæ is exceedingly interesting. They are composed of a prolongation of the granular parenchyma, covered by the transparent layer. At the summit of each papilla, the parenchymic substance is produced through the external layer, as an acuminate soft cilium or spine.

I have already noticed the extensive occurrence of these soft spines, which I have called Palpocils, in the lower classes of animals, as instruments of adhesion or tact. We find them occurring, in an exaggerated state, in some of the protozoa, as in *Actinophrys*, *Podophyra*, and *Acineta*; on the tentacles of *Hydroid* and *Helianthoid Polyps*, accompanied generally, but not invariably, by thread or sting cells; in the polyzoa, situated on the small papillæ, concealed within the jaws of the avicularia, or bird's-head processes of *Cellularia ciliata* and others; in the Mollusca, as in the adhesive tentacular fringes of *Lima* and others, and on the dorsal papillæ of the *Eolidæ*; in the Turbellaria; and in the Annelidæ, as in the tentacles of *Terebella* and others. Probably the long motionless cilia which grace the tentacles of some of the Rotiferæ, as in *Staphanoceros* and *Floscularia*, are of the same nature as these processes.

On forcibly pressing the tentacle of *Spio*, the spine-bearing papillæ burst, and there issues from each of them a body of a very peculiar kind. This body is a pear-shaped capsule (fig. 20, *a*), which issues from the papilla in which it lies concealed, with its broad end in advance. Under stronger pressure the capsule also bursts, and discharges its contents (*b*), —a multitude of acicular spicules, sharp at each end.

It is impossible to resist the conviction that these sacs are analogous to the thread-cells of the polyp, although their structure differs very considerably from that of the latter organs. They approach more nearly to the tricho-cysts discovered by

Allman in *Bursaria leucas*, a protozoan animaleule, which consist of fusiform capsules, having a single spicule in their interior, or to the globular thread-cells of *Cydippe*, described by myself, which contain a simple coiled thread, unaccompanied by the usual invaginated sac which occupies the thread-capsules of the Hydroid Zoophytes.

We cannot, I think, doubt that the tricho-cysts of the subject of this communication are instruments of offence, like the thread-cells of zoophytes. If so, woe to the unlucky inhabitant of "the broad sea wolds" who shall be clasped by the white and blushing arms of Spio, once a powerful Nereid and grand-daughter of Oceanus and Terra, to whom the piety of mankind made offerings of the choicest of milk, oil, and honey, now degraded to the form of a cruel and voracious little worm, and fed by dilettante naturalists on morsels of native oyster. His fate will be like that of the unfortunate whom we have all read of, who, drawn gently into the arms of what seemed a beautiful maiden, suddenly found himself transfixed by a hundred hidden blades projecting through the rich silk that covered her breast.

IV. *Ornithological Notices.* By JOHN ALEX. SMITH, M.D.
(The birds were exhibited.)

These notices record instances of the capture of some of our rarer birds.

1. The HONEY BUZZARD (*Pernis apivorus*, Cuv.). A very fine specimen of this rare hawk was killed in Selkirkshire, near the town of Selkirk, on the 12th or 13th of June last. The bird, which I examined, was an adult female, measuring fully two feet in length from the bill to the tip of the tail, and seventeen and a-half inches from the flexure of wing to its extremity. Its stomach was filled with white-skinned caterpillars, the larvæ probably of wasps, or some other Hymenopterous insects, which form its favourite food ; and the ovaries contained eggs the size of marbles. It is distinguished from the other British hawks by the small, closely-set, scale-like feathers, of a greyish colour, which cover the lore, or space between the bill and eyes. Through the kindness of Graham Bell, Esq., advocate, I am enabled to exhibit a fine specimen of the honey buzzard, which was shot some five or six years ago by one of his sons, on his property of Castle'oer, in Eskdale, on the borders of Dumfriesshire, thus adding another instance of the bird being captured in Scotland. Mr Bell also informs me that two specimens of Quail (*Coturnix vulgaris*) have been shot at Castle'oer within the last five years.

2. The MOOR BUZZARD or Marsh Harrier (*Circus aeruginosus*, Yar.). This bird was shot in July 1855 to the south-west of Falkirk, on the estate of Callender, the property of William Forbes, Esq. It shows the dark brown plumage and the light-coloured head and throat, distinctive of the species. It is a very rare hawk in Scotland, but is said to be not uncommon in some parts of England, frequenting low, marshy districts of the country.

3. The PIED FLY-CATCHER (*Muscicapa luctuosa*, Temm.). It was shot in the first week of June 1855, in the garden of Nisbet, about two miles south of Dunse, in company with some of the common spotted fly-catchers (*Muscicapa grisola*, Linn.). This specimen is a male, distinguished by the white spot across the forehead ; which, in this bird, is not very brilliant, and the upper parts are dusky-brown, mixed with black, the latter especially on the head and back ; the quills and tail are brownish-black ; it is apparently a young male. The female has no frontal white spot ; the plumage generally is duller, the upper parts being of a light brown colour ;—I exhibit one shot in Yorkshire. The pied fly-catcher is a rare bird, and of very local occurrence in England. I have been able to find only one other instance of its occurrence in Scotland,—recorded in the *Naturalist*, vol. ii., p. 239, by J. Longmuir jun., Esq., Aberdeen, in which neighbourhood the bird was shot. Like the other fly-catcher, it is a summer visitor ; and Gould, in his “Birds of Europe,” says, “In the British isles this interesting bird is exceedingly local in the districts it chooses for its periodical visits. Arriving on the return of spring from the more congenial and warmer portions of the old Continent, it takes up its abode, not, as might have been expected, in the southern parts of our island, but in the northern and midland counties, especially Lancashire, Yorkshire, and Derbyshire, finding probably either food, or some other inducement, of which we have no knowledge, that is suited to its wants.” We might suppose the specimen of pied fly-catcher, which I exhibit, to be merely an accidental visitor to Scotland ; but I am rather inclined to think it may have been overlooked among our regular summer visitors from its very local distribution, as Mr Stevenson, who shot the bird, in answer to my inquiries, informs me, he also saw a male bird in the same locality in June this year, but did not succeed in capturing it. He observed it, however, only on one day.

4. The NUTHATCH (*Sitta Europaea*, Linn.). The nuthatch, a bird of wooded districts, is found in the midland and southern counties of England, but has been traced by Mr Selby as far north as the banks of the Wear and Tyne. It remains in England all the year ; and, according to Macgillivray, has not hitherto been observed in Scotland. Sir W. Jardine refers to Mr Selby’s tracing it as far as the Tyne, and states that we have no record of its occurrence further north. I have much pleasure, therefore, in adding the nuthatch to the list of birds found in Scotland, this specimen having been killed in the garden at Nisbet, near

Dunse, about the middle of March last, when running over the trunk of an oak tree.

5. The CRESTED TITMOUSE (*Parus cristatus*, Linn.). This bird was taken several years ago in the neighbourhood of Dumbarton, in a glen popularly known as Lot's Wife's Glen (from the presence of an ancient standing-stone which has apparently suggested the Scriptural name to the locality). It is at once known by its elongated crest of black feathers edged with white. As a British bird it appears to have been observed only in Scotland, generally in the large pine forests of the north, as Glenmore, the Pass of Killiecrankie, and also in fir plantations not far from Glasgow, as mentioned by Sir William Jardine.

6. By the kindness of one of our Members for the city, Charles Cowan, Esq., M.P., I exhibit to the Society a beautiful specimen of the BITTERN (*Ardea stellaris*, Linn.), a bird which has of late years become comparatively rare, the progress of land improvement and draining having nearly driven it out of the island; occasionally, however, several specimens are taken at uncertain intervals, and generally in the winter months. The specimen exhibited—an adult male—was shot, during the severe frost, on the 5th of December, on Mr Cowan's property to the south of the Pentland Hills. I exhibit another fine specimen of the bittern, also an adult male, which was shot at Bankton, near Mid-Calder, on the 23d of December. On examination, the stomach contained the elytra of the large water beetle, *Dytiscus marginalis*.

7. I take the opportunity of showing the Society two of those strange instances of loss of colour, birds seem occasionally subject to; the one a common STARLING (*Sturnus vulgaris*), which, instead of its usual dark plumage, has become almost entirely pure white; it was shot near Bathgate in June last; the other, a THRUSH (*Turdus musicus*), killed in the neighbourhood of Glasgow sometime ago, which has apparently been undergoing a similar change, but is of a pale yellow, or yellowish-white colour.

8. And lastly, Mr Carfrae, bird-stuffer, has sent for exhibition, a living specimen of a *mule*, the progeny of a male goldfinch and female bullfinch, which he considers of interest to Bird Fanciers; and the first, he believes, that has been bred in Edinburgh. For comparison he has sent the parents along with this bird, which was reared by him last summer, and is therefore in its first year's plumage. Of the *goldfinch*, it shows the red colour of face, the brown back, the yellowish bar on wing, and the white spots on tail feathers; of the *bullfinch*, the swollen beak (though it is of a light colour, with the black spot at point like goldfinch), the reddish coloured breast, the bar on wing is like the bullfinch, but of the yellow colour of the goldfinch, glossy black quills of wing, and white upper tail coverts—a curious blending of both its parents.

V. Notes on the British species of *Patella*, from information communicated by Dr Knapp. By ANDREW MURRAY, Esq., W.S.

The object of this paper was to point out a very marked variety of the *Patella vulgata*, which had been found by Dr Knapp in Guernsey and Jersey. It was principally characterized by its rich yellow or brown-creamy colour inside, its more depressed form, and more prominent ribs, white at the top. A very fine series of specimens, both of this variety and the other British species of *Patella*, was exhibited. Notwithstanding its marked peculiarities, Mr Murray considered it only a variety of *P. vulgata*, and proposed to call it *P. vulgata*, var. *intermedia*.

Wednesday, 25th February 1857.—Professor BALFOUR, President, in the Chair.

The following donations were laid on the Table, and thanks voted to the donor:—

1. *Memorias de la Real Academia de Ciencias de Madrid.* Tomo 30, Ciencias Fisicas, 2a Serie. Tomo 10, parte 1a, 1856. 2. Tomo 40, Ciencias Naturales, 3a Serie. Tomo 20, parte 1a, 1856. *Programa de Premios para el año de 1857.* 3. *Anuncio del Eclipse Anular y Central que Tendra Lugar el 15 de Marzo de 1858.* Por Don Antonio Aguilar. From the Royal Academy of Sciences of Madrid.

The Communications read were the following:—

I. *On the genus Ateuchus (the Egyptian Scarabæus), and its South American representatives, with descriptions of new species of the latter.* (Specimens were exhibited.) By ANDREW MURRAY, Esq. W.S.

Mr Murray commenced by referring to the interest which attached to this group of beetles, from its having been an object of veneration to the ancient Egyptians, and sculptured so frequently on their ancient monuments. He exhibited a series of specimens of these antiques, and pointed out that it was quite easy to distinguish to which species they ought to be referred. Those specimens exhibited all belonged either to *Ateuchus sacer*, or *Ateuchus laticollis*. He detailed several interesting anecdotes connected with their habits, and their wonderful instinct of making, rolling, and burying balls of excrementitious matter, generally containing their eggs. He also explained their geographical distribution, showing that they were confined to the Old World, but possessed representatives in South America (known under the generic name of *Eucranium*), bearing a very close affinity to a South African species (*Pachysoma Äsculapei*). He concluded by describing some new species of these South

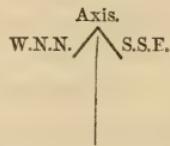
American beetles, which he had received through the kindness of Dr Stark of Edinburgh, to whom they had been sent from the deserts of Cordova, by Mr Black, a zealous naturalist (son of our respected Member for the city), who is now in Chile.

II. On the Contemporaneous Geological Age of the "Mountain" and "Burdiehouse" Limestone Beds of the Linlithgowshire Coal-Field.
By ANDREW TAYLOR, Esq.

The object of Mr Taylor's communication was to describe a geological section in the Bathgate Hills—taken from Dechmont Law to Balbardie House, in which a limestone containing fresh-water fossils, and equivalent to the one worked at Burdiehouse, gradually merged into another limestone containing marine fossils, which is usually recognised as the lowest bed of the carboniferous series.

The axis of the hills occurs on a wooded prominence overlooking the Caput Hall bogs, and near the "Clinking Stane." At this point the limestones may be traced within a few hundred yards of each other, dipping N.N.W. and S.S.E. The Kirkton limestone,—a peculiar bed described by Dr Hibbert, containing both marine and fluviatile remains,—intervenes. Eastward from the prominence just indicated, both the axis of the hills, and the connection of the limestones, may be traced in the burn running through Bengour farm, at Binny, and thence at various points to the shore of the Forth at Hopetoun.

From the section described, the succession of the strata on either side of the axis, comprising the country eastward to Edinburgh on the one hand and westward to Shotts on the other, was inferred to be as follows:—



3. Upper Lanarkshire coal-measures;— wholly fluviatile organic characters. 2. Beds of marine and fluvio-marine lime- stone, intercalated with shale, coal, ironstone, and stratified trap. 1. Shales, sandstones.	3. Sandstones, shale, and a bed of coal. 2. Fresh-water limestone. 1. Shale, sandstone, tufa.
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It was argued that the extensive beds on the N.W. side of the axis had been denuded at the south-eastern side. The beds of intercalated trap in the basins on the north-western side had prevented their valuable mineral contents from being swept away.

On the Bathgate Hills the marine limestone is sixty feet thick, and the fluviatile limestone about twenty feet thick. But towards the south-west, on the borders of Edinburgh and Lanark shires, the marine limestone thins into beds of from three to six feet thick, whilst the fresh-water bed

is above fifty feet thick. It would seem, then, more correct to ascribe the palæontological remains found in these beds not to two different geological epochs, but to one ; and to assign their difference in character to varied local geologico-geographical conditions.

No locality has as yet been found on the Bathgate Hills, where the connection of these strata with the Old Red Sandstone series may be traced. But this is afforded on the south-western boundary of the Lanarkshire coal-field, particularly at Kiln-Cadzow, near Carlisle.

If, as some suppose, this part of the central district of Scotland was a narrow strait having access to the sea in the Old Red Sandstone epoch, the palæontological evidence of the strata under review would seem to indicate that, in the period immediately succeeding, the main physico-geographic features were a cutting off of the access to the ocean, and a gradual increase of the land.

Some of the trap rocks of the district seem to be of the same age as the limestones. Upright stems are found in the coal strata immediately above them, particularly in the celebrated Torbanehill bed. May not the Bathgate Hills, having received an elevatory movement immediately after the deposition of the limestone strata, have formed a margin of the lagoon in which the Lanarkshire coal-beds were deposited ?

III. (1.) *Notice of the occurrence of Apophyllite at Ratho.* (Specimens were exhibited.) (2.) *Sections of Lepidostrobi were exhibited.* By ALEXANDER BRYSON, Esq.

Mr Bryson exhibited some beautiful specimens of *Apophyllite* (the *Tesselite* of Brewster) from the greenstone quarries at Ratho, and remarked that mineralogists were much indebted to the labours of Mr George Forrest of Nicolson Street for this new addition to the mineralogy of the neighbourhood. Mr Forrest had also found three other minerals new to this locality.

Several carefully prepared sections of *Lepidostrobi* and *Stigmaria* were exhibited by Mr Bryson, as also photographs of their microscopic structure.

IV. *Notice of a Discovery of Diatomaceæ in the Marls of Waitnean and Brakegoe, near Wick, Caithness-shire.* By CHARLES W. PEACH, Esq., Wick. (Specimens of the Marl were distributed among the Members for examination.

The great value of the marls of Caithness has long been known to those engaged in agriculture. The chemist has shown the great per-cent-age of calcareous matter they contain, and enumerated the other constituents that make up the weight of the analysis,—silex in a small quantity being one of the latter. Although silex has thus been pointed out, the source

whence derived has not been noticed ; the purport of this paper is to supply that omission. Until Good Friday last I had not seen any of this marl. As this day is always a customs holiday, and is not kept as a holy day in the north, I took a walk as far as Witnean, a little more than seven miles from this place, to look at the deposit there. On taking up some marl which had been laid on the bank of the loch, I fancied, from its peculiar character, that I knew the source of the supply of silex, at least the greater part of it. On my return in the evening, I placed a very small quantity of the marl on a slip of glass and saturated it with water ; then laid another piece of glass on this, and transferred the whole to my microscope, and was delighted to find, as I had suspected, that diatomaceæ, those lovely siliceous, but somewhat doubtful vegetable forms, were abundant in it. I forwarded some to London ; this was handed to Professor Smith of Queen's College, Cork, the author of the standard work on Diatomaceæ. He kindly examined it, and sent me a prepared slip, with a list of those found by him in the first examination, showing forty-three species belonging to twenty genera, and added, &c., &c. As well as these, there were a great number of spiculæ of the fresh-water sponge (*Spongia fluvialis* of Johnston). He, however, met with no new forms. Professor Arnott of Glasgow has also examined some, and finds diatomaceæ abundant. Christopher Johnson, Esq. of Lancaster has devoted a good deal of attention to it, and says that he has found at least one new and undescribed ; and we may reasonably hope that when the “ &c. &c., ” are worked up, the list will be greatly extended. There is another deep deposit at Brakegoe, near Thrumster, five miles from this place, which also abounds in similar forms, but not quite in such abundance. As well as these two lochs, marl is met with in various parts of the county. From some of these deposits I have obtained small parcels ; they are comparatively bare of diatomaceæ. I wish to speak cautiously here. From not having collected the marl myself, I may not have been furnished with good samples. Should I ever have the pleasure of visiting these localities, I hope to give all a careful examination. As I intend this more as a medium of introducing the marl to the notice of microscopists, and to request the distribution of it amongst our members, than as an essay on diatomaceæ, I trust that it will be accepted as such ; and I hope that they will feel as much pleasure in the examination as I have. I could willingly dwell on many interesting particulars and facts connected with the extent and depth of these deposits—the manner of using the marl—the good effected by the proper use of it, as shown by the thousands of acres of land brought into cultivation and benefited, and, *per contra*, the great injury caused by injudicious application—and then of the animal and vegetable matter of which it is composed—showing the infancy, youth, and beauty—perfection, age, and decay—of the millions upon millions of organized objects which have lived and died, and whose remains are buried in these lochs—and then the lengthened periods that must have passed

during the formation of such deep and extensive beds. I must, however, content myself with a few words about the organic silex. It is well known that silex forms part of the substance of plants, and that it is interwoven in their tissues. Some plants contain more of it than others. This organic silex has caused much speculation as to how such an apparently indestructible substance could be decomposed and converted into proper matter for this supply. Am I wrong in supposing that these delicate and impalpable shields may be sufficiently minute to be drawn up by the sap from the marl used as manure, and by one of those delightful—but at present unknown—processes going on in nature's laboratory, transformed into a shape adapted to the want of the growing plant? However delightful it might be to follow this thought farther, I must desist, and merely suggest that the marl from these deposits, containing so much silex, might probably be used in the same manner as tripoli, first separating the diatomaceæ from the lime, which latter, from its peculiar character, might also be used for other economic purposes as well as for manure. Should this be attempted, it could be obtained in almost any quantity.

V. (1.) *Notice of the Horn of a Reindeer (Cervus tarandus, Linn.), found in Dumbartonshire.* By JOHN ALEXANDER SMITH, M.D.

At the close of last session, I exhibited to the Society several shells and a deer's horn, which had been recently found during the excavation of a cutting on the Forth and Clyde Junction Railway. My friend, James Macfarlane of Balwill, Esq., knowing the district well, was kind enough to draw up at my request a "memorandum," formerly read to the Society; and I have since been furnished with some additional information. The locality in which the horn, shells, and fragments now on the table were found is situated in the county of Dumbarton, and parish of Kilmarnock, immediately adjoining the hamlet of Croftamie, in the basin of the river Endrick (which flows into Loch Lomond), and at a distance of nearly a mile from that river, and about four miles from the nearest part of Loch Lomond. The superincumbent mass consisted first of the vegetable mould, then of a stiff till about twelve feet thick, containing a large quantity of stones, some of a round form, apparently water-worn, others angular, and many of them of a great size. Under the till was a bed of blue clay about seven feet thick, and at the lower part of this bed, and close upon the sandstone rock, the horn was dug out of the clay at the depth of about eighteen feet; and at a few yards' distance the shells were found in a similar position, lying at a depth of about twenty-one feet from the surface, the ground cut through rising a little higher at that part. As nearly as can be calculated from the railway plans and sections, these remains lay from 100 to 103 feet above the level of the sea. The shells consisted of the following species:—*Cyprina islandica*, *Astarte elliptica*, and *A. compressa*, *Fusus antiquus*, *Littorina littorea*, and the

shelly base of a species of *Balanus*. They are all marine species, at present inhabiting the neighbouring seas. I previously noticed their relation to beds of marine shells found near the shores of Loch Lomond, pointing to a total change in the character of the district, when Loch Lomond existed as an arm of the sea. But into this subject I do not again enter, my communication now referring to the deer's horn (which I exhibit), the

Fig. 2.

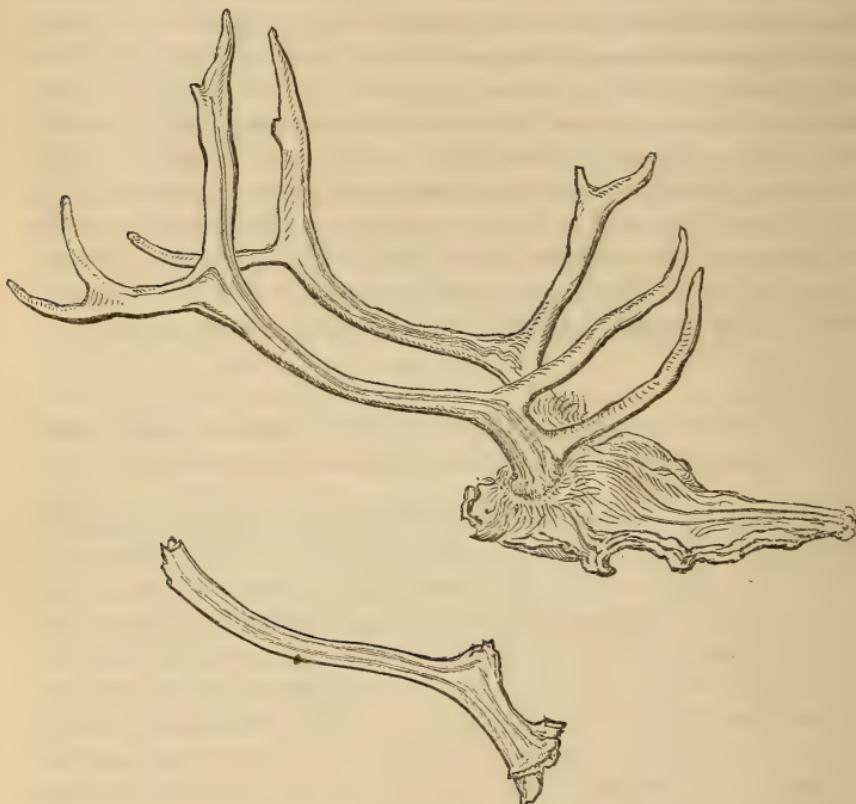


Fig. 1.

other object of interest found in the railway cutting. The horn was supposed at first to be simply that of a red deer, which, from being water-rolled, had become smooth. The Society, however, would remember I stated that I was inclined to consider it as belonging to the reindeer. It is a fragment of the horn of the right side (fig. 1), and has been broken off obliquely, just below the slightly prominent burr,—it shows the origin of the brow antler close to the burr, and at about two inches' distance that of a second antler, or tine, at which part the horn is much compressed in its character, the origin of the antler being quite flattened; beyond this we have the smooth and rounded beam, becoming again compressed and angular at the upper part, where it is broken across. The horn is small, measuring $11\frac{1}{2}$ inches in length, and one inch in breadth midway between the origins of the antlers. These characters all agree closely with the horn of the reindeer. Since the meeting of the Society, at which it was

previously exhibited, I have been anxiously seeking for small-sized horns of the reindeer to compare with it, and at last was fortunate enough to get the horns of a young or female reindeer, of the American variety. I exhibit these horns, and the Society will at once see the very close resemblance between them (fig. 2). (I am indebted to T. B. Johnston, Esq., for kindly favouring me with the annexed careful drawing, which shows the relation between this broken horn and the perfect horns of the recent reindeer.) And, to set this matter completely at rest, I then forwarded the horn to our great authority in fossil remains, Professor Richard Owen of London, who favoured me with the following reply :—" It gives me pleasure to inform you that the portion of antler from the basin of the Endrick, which you sent for my inspection, is of a young or female reindeer of the existing species, and if, as is most probable, a female, of the large variety called 'Carabou' by the Hudson's Bay trappers." Professor Owen, in his valuable " History of British Fossil Mammals," refers to two instances of the cranium or horns of the reindeer being found in England. The only instance described, as far as I am aware, of its occurrence in Scotland, is that recorded by Dr Scouler of Glasgow, in the " Edinburgh Philosophical Journal" of 1852, p. 135. This consisted of a portion of the distinctive palmated brow-antler. I have much pleasure, therefore, in recording another instance of the remains of this animal—now so exclusively a native of the more northern parts of Europe and America—being found in Scotland.

(2.) *Notice of the Wood Sandpiper (Totanus glareola, Temm.) Shot in Mid-Lothian.* By JOHN ALEX. SMITH, M.D.

The wood sandpiper which I exhibit was kindly sent to me by Richard Bell, Esq., who shot it on the 14th of August last on a moor a little to the west of the village of Heriot, among the Muirfoot Hills. It rose from the side of a pool or peat-hag, flew much like a snipe, which he supposed it at first to be, alighting at no great distance, when he sprung it again and killed it. The bird is considered a rare occasional visitant of England, and three specimens have been recorded by Mr Selby, taken as far to the north as Durham and Northumberland. In this specimen, the dark brown feathers of the back and scapulars are spotted round the edges with fawn-colour, showing the plumage of the young bird ; and as the district is just such a one as they are described by naturalists as selecting for incubation on the Continent, it seems not impossible this locality may be visited for a similar purpose. The bird is a male. The stomach was filled with semi-digested remains of insects, including, as my friend Mr Andrew Murray informs me, the following genera and species :—*Gyrinus*, *Hydroporus*, *Donacia micans*, *Colymbetes Sturmii*, &c. This appears to be the first time the bird has been observed in Scotland. Sir William Jardine, to whom I sent the specimen for examination, informs

me that—"There is no doubt of the bird being the *Totanus glareola*, Temm., as you suppose; but it is an interesting specimen, as I am not aware of any other being recorded as killed in Scotland, although it has been got in Northumberland and the borders. Your bird, I think, is in its first year's plumage, indicated by the brown markings, and the thickening of the tarsal joints. The season in which it was obtained, also, is just that of their leaving the breeding places."

Wednesday, 25th March 1857.—ANDREW MURRAY, Esq., W.S., President, in the Chair.

Allen Dalzell, M.D., was balloted for and elected a Member of the Society.

The following eminent foreign naturalists were then elected FOREIGN MEMBERS of the Society:—

Charles H. Boheman, Professor in the Museum of the Royal Academy of Sciences of Sweden; Auguste Chevrolat, late President of the Entomological Society of France; C. A. Dohrn, President of the Entomological Society of Stettin; Milne Edwards, Member of the Institute, and of the Legion of Honour, Professor of Entomology in the Museum of Natural History, Paris; Leon Fairmaire, Paris, author of the "Faune Entom. Française;" A. Gerstaecker, Director of the Museum, Berlin; M. Achille Guenée, Chateaudun; Charles Javet, Paris; G. Kraatz, Berlin, author of many Entomological works; Theodore Lacordaire, Professor of Zoology and Comparative Anatomy in the University of Liege; Dr J. L. Leconte, Philadelphia, author of many American Entomological works; L'Abbé de Marseul, Paris, author of the "Monograph of the Histeridæ;" Guerin Meneville, Chevalier of the Legion of Honour, editor of "Revue et Magazin de Zoologie;" M. Obert, Corps de Cadets, Paulou, St Petersburg; M. Reiche, Paris, author of many Entomological works; The Marquis de Laferté Senectére, Tours; Professor P. C. Zeller, Gross-Glogau, Silesia; Professor J. W. Zetterstedt, University of Lund.

Specimens of insects from the Crimea were exhibited, amongst which were several locusts and carabi,—a donation to the Society from James Black, M.D.

The Communications read were as follows:—

I. *On the Geology of the Neighbourhood of Elie.* By the Rev. WALTER WOOD, A.M., Elie.

The paper was confined to a view of the relations between the trap and the sedimentary rocks, as displayed on the shore. The prevailing trap rock has been commonly called trap tuffa, but is known by the local name

of "Leck." It is uniformly stratified, and never occurs superimposed upon the Coal Measures. The alternate patches of the two rocks are separated by faults filled up by wacke and fragments of sandstone. Hence it would appear that the "Leck" had at one time uniformly covered the sedimentary rocks; that the mass had been broken up by faults; and then by denudation the whole of the tuffa had been removed, except such portions as had sunk to a lower level. It was remarked that the sandstone presented an indurated character, even when not in the neighbourhood of the tuffa, and was entirely unaltered in one case where a mass of basalt rests upon its surface. In this case the basalt is separated from the sandstone by a horizontal layer of wacke, in the centre of which occurs a mass of stratified sandstone, while the upper portion of the wacke passes gradually into basalt. The harbour of Elie presents a mass of sandstone completely surrounded by stratified trap tuffa, the strata of both the rocks being highly inclined. On the neighbouring shore the land is fast gaining upon the sea by the accumulation of blown sand. Lately, at a point at least 100 yards from the high-water mark, stone cists or coffins were exposed in an excavation which was made, and close to them the ancient beach was disclosed in a mound of rolled pebbles some ten or twelve feet high. The sand must already have begun to gather before the burial took place. The author concluded by describing very minutely three distinct terraces, the highest 100 feet above the present sea level, which occur on the western side of Kincraig Head, and may be traced to a considerable distance, and invited the Members of the Society to inspect the shore for themselves, offering them every assistance in so doing.

The communication was illustrated by the Ordnance Survey Maps, and a coloured geological map of the district; numerous specimens were exhibited in illustration of the different geological details referred to.

II. *Analysis of Three Waters from Palestine, viz.: The Water of Marah; the Hot Springs of Tiberias; the Baths of Pharaoh.* By ALLEN DALZELL, M.D.

The waters in question had been sent to the College Laboratory by Dr Stewart of Leghorn, by whom they were brought from the Holy Land. The first water Dr Dalzell wished to mention was from a spot little visited by travellers, on the western side of the Sinai peninsula, and was believed by Dr Stewart to be the "Marah" of Scripture. As taken from its source it was found by that gentleman to be charged with sulphuretted hydrogen. The Marah water, as he received it, had a specific gravity at 60° of 1008.5, and contained 1400 grains of solid matter in the imperial gallon. The following showed the nature and proportions of the constituent salts:—

Chloride of sodium	.	.	.	.	40.725
Sulphate of lime	.	.	.	.	12.520
Sulphate of magnesia	.	.	.	.	40.716
Chloride of magnesium	.	.	.	.	6.040
					100.000

The second water was that of the Baths of Tiberias, at its source a sulphureous thermal, and of too high a temperature to permit of the hand being held in it. It had not been previously analysed with care. Dr Dalzell found its specific gravity at 60° to be 1022.5, and the solid residue of a gallon to be 2821 grains, or about twice as much as Marah yields; nearly 80 per cent. of its saline matter was common salt, as the following table showed:—

Chloride of sodium	.	.	.	.	76.85
Sulphate of lime	.	.	.	.	11.01
Sulphate of magnesia	.	.	.	.	12.14
					100.000

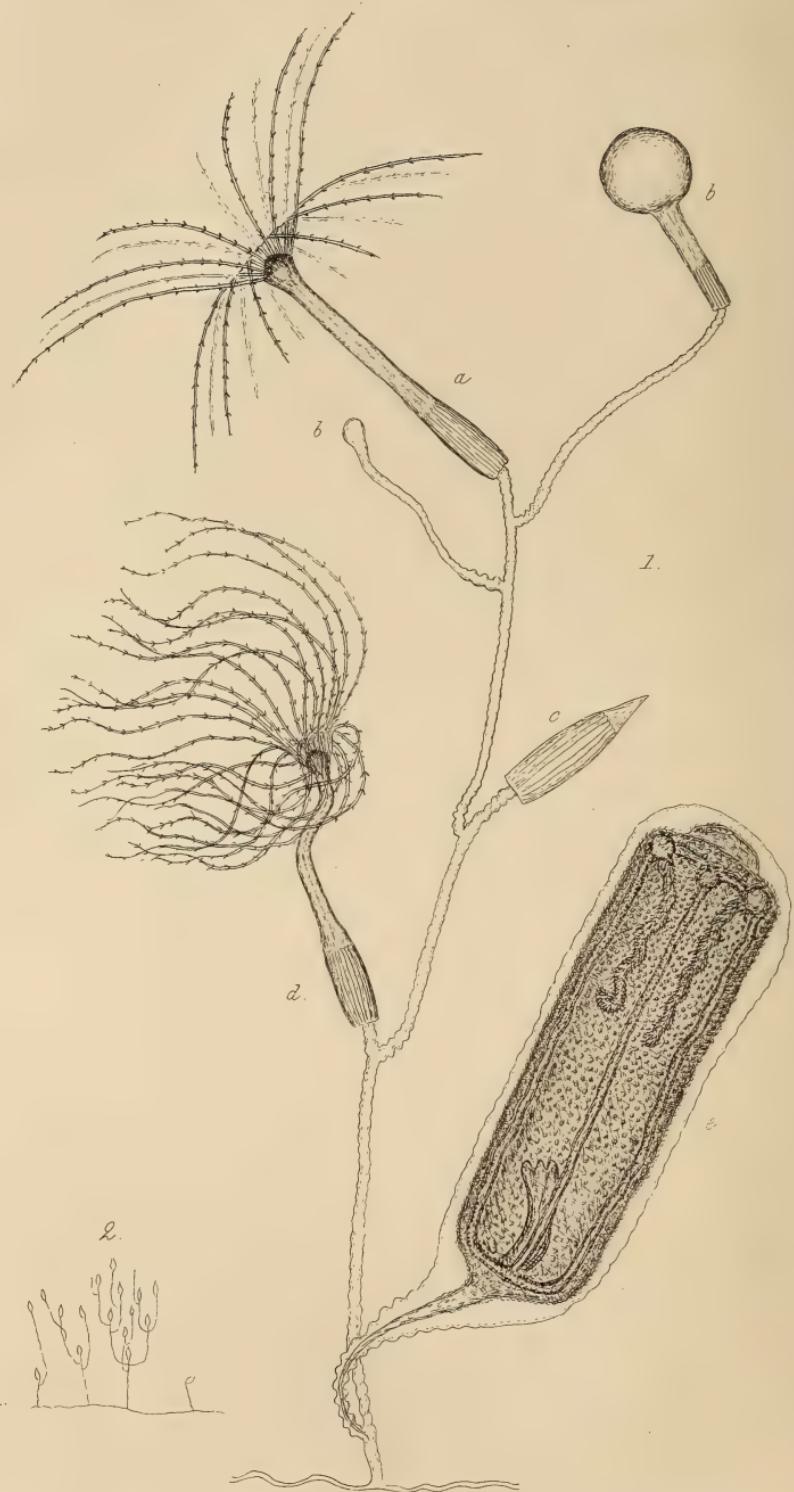
The third water was also sulphureous and thermal. Its original heat must have been great, as, from some notes accompanying the bottles, it appeared that a thermometer graduated to 120° Fahrenheit, instantly burst on being immersed in it. At 60° he found its specific gravity to be not far from that of the Marah well, viz., 1007.9, and the solid residue from a gallon 1211 grains. Like the Dead Sea, it contained much magnesia, and, as in that water, so here, the amount of sulphate of lime was smaller than in either of the preceding. Its analysis showed, of

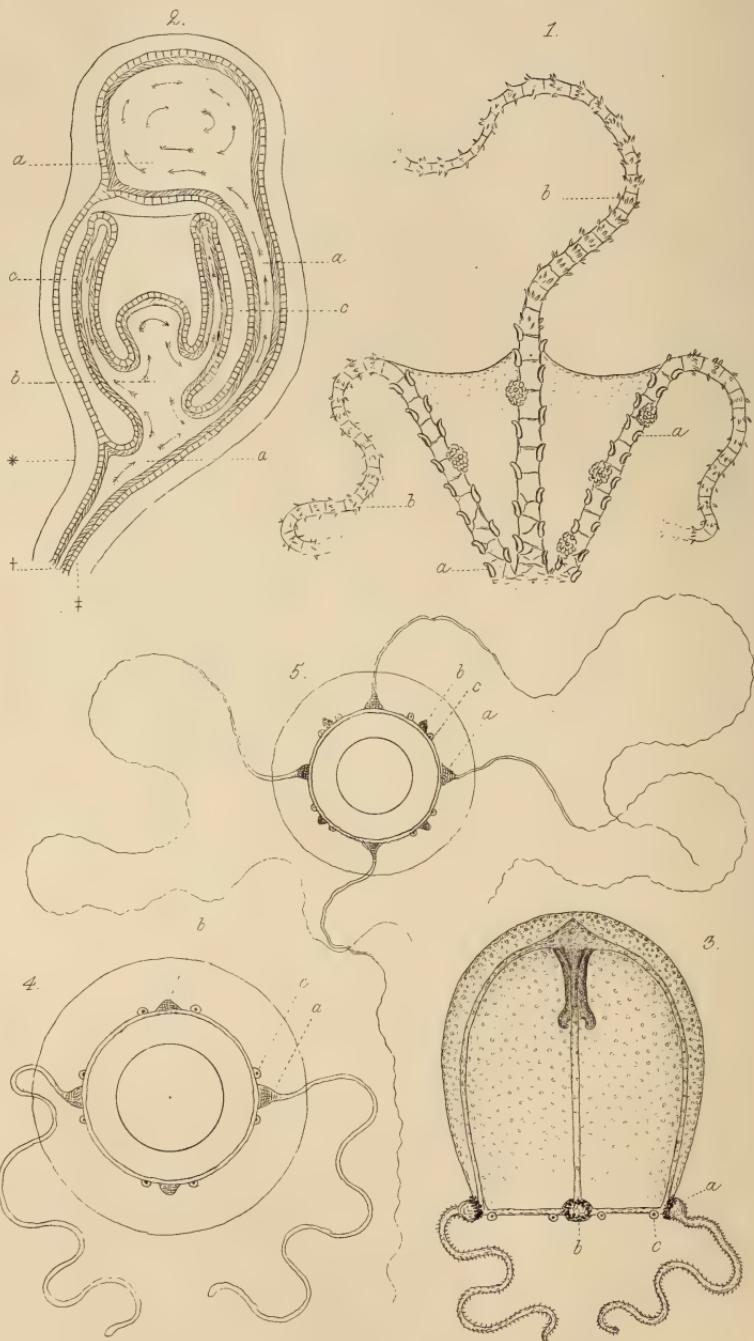
Chloride of sodium	.	.	.	.	73.215
Sulphate of lime	.	.	.	.	6.720
Sulphate of magnesia	.	.	.	.	20.065
					100.000

Dr Dalzell concluded by stating, that in a portion of Dead Sea water taken from the northern end, the specific gravity of which was 1210 at 60°, he found 17,402 grains per gallon of solid matter, 56.12 of which was chloride of magnesium, 29.62 chloride of sodium, 11.25 chloride of calcium, a little more than 2 per cent. chloride potassium, 0.43 sulphate of lime, and 0.28 consisted of the bromides of magnesium and potassium.

III. (1.) *A few Fossils from Vancouver's Island were exhibited.* (2.) *Notice of a Tetraodon (believed to be new) from Old Calabar.* (The specimens were exhibited.) By ANDREW MURRAY, Esq.

Mr Andrew Murray exhibited a few fossils from Vancouver's Island. They belonged to the Lower Chalk, and consisted of a species of ammonites and baculites (*B. ovatus*, Say.), *Diceras* (*Caprotina*, D'Orb.), *Venus*, *Unicardium*, and *Psammobica*.







Mr Murray also exhibited a species of *Tetraodon* received from Old Calabar, through the kindness of Mr Wylie. It did not correspond with any of the species described by Lacepede, and was probably new. Instead of being armed with great spines, it was nearly smooth, except on the belly, where it was covered by a number of small prickles. It was dark brown above, and pale beneath, and had a row of six deep red spots along its sides. Mr Murray named it provisionally *T. pustulatus*.

IV. *Observations on British Zoophytes.* 1. *Laomedea acuminata.* 2. *Trichydra pudica.* 3. *Tubularia indivisa.* 4. *Description of New Protozoa.* By THOMAS STRETHILL WRIGHT, M.D., Fellow of the Royal College of Physicians, Edinburgh.

DESCRIPTION OF PLATES.

Plate XIII.

Fig. 1. *Laomedea acuminata*, highly magnified—*a* polyp with tentacles expanded—*b* bud with growing polyp—*c* empty cell—*d* polyp disturbed—*e* capsule containing medusoid.

2. *L. acuminata*, magnified two diameters, to show the branched and unbranched states of the polypary.

Plate XIV.—*Laomedea acuminata.*

Fig. 1. *a* bases of three tentacles of polyp united by their connecting membrane, and studded with large thread-cells and masses of granules—*b* unconnected portion of tentacles, furnished with small thread-cells.

2. Ideal section of capsule containing medusoid taken at an early stage—*corallum, †ectoderm, ‡endoderm—*a* reproductive polyp—*b* medusoid inclosed within *c*, a sac formed by a layer of ectoderm. Circulation indicated by arrows.

3 and 4. Medusoid of *L. acuminata*, compared with fig. 5, medusoid of *Campanularia Johnstoni*—*a* tentacles—*b* rudimentary tentacles—*c* auditory capsules.

Plate XV.

Trichydra pudica.

Fig. 1. Polyps—*g e c* in various stages of contraction—*f* with buccal cavity everted—*d b* extended—*a* young polyp.

Tubularia indivisa.

2. Transverse section of polypary near the summit—*a* corallum—*b* ectoderm—*c* endoderm pierced by *e* longitudinal canals.

3. Summit of polypary from which the polyp has recently fallen—*a* longitudinal spiral canals—*b* irregular transverse striae, indicating the fall of successive polyps. Course of circulation marked by arrows.

1. *Laomedea acuminata*.

A beautiful zoophyte was discovered by Mr Alder, and described by him in the last December number of the "Annals of Nat. Hist.," under the title of *Laomedea acuminata*, which I am disposed to consider identical with the subject of this notice. It has been familiar to me since March last, when I found an old pecten shell in one of the tanks of my friend Dr Paterson of Leith, covered with its flower-like polyps. In May it was dredged up on an old oyster shell from the Frith of Forth, and sketched by myself and Dr Mackay; and in August, a fine specimen occurred on a living oyster in the vivarium of the Edinburgh Zoological Gardens, which has been domesticated with me ever since, and which I place on the table to-night. Mr Alder describes it thus: "*Laomedea acuminata*—Polypary minute, scarcely branched, with a slender annulated stem; cells thin, membranous, finely striated longitudinally, elongo-ovate or pod-shaped, squared below and tapering to a fine point above; margin slightly crenulated; polyp reaching, when extended, to two or three times the length of the cell, with about twenty muricated tentacles." He remarked, also, that the tentacles were united by a web for about one-sixth of their length, which he has well shown in his figure of the polyp. In all the specimens in my possession the tentacles, instead of being erected as in Mr Alder's figure, were alternately erected and depressed (Plate XIII., fig. 1, *a*), as they reached the top of the membranous funnel which united their bases together.

The distinguished discoverer of this Zoophyte found much difficulty in ascertaining the true shape of the margin of the cell, on account of its exceedingly thin and membranous texture. This membrane, however, appears to me to be an additional softer structure, which incloses the cell proper, and, projecting beyond the mouth, falls twisting together when the polyp retires within its cell. Old cells, accordingly, which have long lost their tenants, are destitute of this membrane, and present an even rim like old cells of *Campanularia syringa*. In my specimens, moreover, the cells were inclined to their annulated stems. The long lax tentacles were muricated with small thread-cells, while the inner surface of the membranous

web or funnel was studded with thread-cells of very large size, ranged along each side of the tentacles. (Plate XIV., fig. 1.) Similar large cells were also found scattered on the body of the polyp.

In September last, buds were put forth from the foot of many of the polyp stems, which became slowly developed into cylindrical capsules, supported on long pedicles, and of large size compared with the minute polyps to which they were attached. As I was obliged to leave home at that time, I examined the capsules, and found in each a single large Acaleph or Medusoid, imperfectly developed within a fleshy sac, which was thickly covered with large thread-cells. During the present month similar capsules again appeared ; and Alcmena never wearied more of her prolonged gestation of Hercules than I did, as day after day these capsules slowly increased in size and revealed the young giant within. At length fierce throes commenced ; but Latona sat cross-legged at the threshold for a night and a day before the sac burst, and a pale-emerald green medusoid was brought forth. *The umbrella* of the Acaleph is colourless, and sub-hemispherical, becoming mitrate during contraction. It is covered with the large thread-cells, which are congregated in greater numbers about the middle and upper parts, and give the animal a shiningly dotted, or gemmed appearance. *The sub-umbrella* is tinted with pale emerald-green by reflected light, and is colourless or faintly orange by transmitted light ; effects probably due to interference of light produced by the fibrous structure of its highly-developed contractile layer. *The stomach or alimentary polyp* is quadrangular. *The tentacles or prehensile polyps* are four in number—two long and two rudimentary ; they are ringed as to their bulbs with deep blue, and are without eye-specks. *The auditory capsules* are eight in number, situated one on each side of the four tentacles. The tentacles and alimentary polyps are furnished with small thread-cells. The Acaleph has no ovaries or sperm-sacs.

The general appearance of this Acaleph resembles that of the Acaleph of *Campanularia Johnstoni* (Alder), of which Mr Gosse has given a figure in his " Devonshire Coast."

Great numbers of the Acalephs of *L. acuminata* were given

off at the same time, and after living a few days, became affected with the convulsive attacks so feelingly described by Professor Edward Forbes, to which infant Acalephs are so prone, and died in contortions shocking to see.

[Since the foregoing observations were communicated to the Royal Physical Society, I have several times obtained *L. acuminata*, and it is now growing in great luxuriance in my tanks. One of the specimens covers a space of 4 by 8 inches on the surface of the glass, with a net-work of creeping fibres, from which polyp-stems spring at very regular intervals of about a tenth of an inch. The polyp-stems of this specimen bear each a single polyp only. In other specimens which are seated on univalve shells, and cannot therefore so readily spread themselves, the polyp-stems become repeatedly branched. In these cases the single polyp-stem gives off one, two, or three branches beneath its cell; these branches in like manner originate others, until the polyp-stem becomes transformed into a more or less bushy shrub, covered with polyps (Plate XIII., fig. 2), and rarely bearing a large medusa-bud, which is generally developed from the first stem.

The medusa-bearing stem (Plate XIV., fig. 2) at an early stage resembles one of the ordinary polyps (Plate XIII., fig. 1, *b*), in an imperfect state of development, having the same transparent globular summit, in which, as well as in the stem, an active circulation of granules may be detected. It may be considered as a reproductive branch or polyp. The medusoid *b* buds forth from beneath the enlarged head, and is inclosed in a sac *c* formed from the ectoderm of the polyp. As the medusoid grows, first the head, and afterwards the body, of the reproductive polyp *a* is absorbed, and the sac of the ectoderm is afterwards ruptured by the vigorous flapping of its inmate. Absorption of the connection between the stem and the medusoid then takes place, and the latter is freed in about six or eight hours afterwards.

The striae of the empty polyp-cells appear to be due to a folded state of the membrane, as they disappear when the cells are fully distended by their inmates.—Dec. 3, 1857.]

2. *Trichydra pudica*.

Shells and stones which have been kept quiet in an aquarium for some time, are occasionally covered with a flocculent net-work of shining fibres, which appear as fine as the lines of a spider's web. This net-work, under microscopic power, is found to be composed of the interlacing tentacles of a multitude of closely-congregated polyps, attached together by a linear creeping polypary (Plate XV., fig. 1). The polyp of this minute Zoophyte (which I have called *Trichydra pudica*, "the modest hair polyp") is about $\frac{1}{8}$ th of an inch in length, and resembles in shape a miniature fresh-water hydra. The whole body is exceedingly attenuated and transparent, with the exception of the buccal cavity, which is of a dense silvery white, and may be distinguished by reflected light as a shining speck, while the rest of the animal is almost invisible. The tentacles vary in number from 4 to 12, with the increasing age of the polyp. They are arranged in a single row, and are long and waving, and muricated with clusters of minute thread-cells, above which project long and finely acuminated "palpocils," the soft prehensile spines I have described in former communications. The buccal cavity is small and conical, and occupies a scarcely elevated papilla situated in the centre of the tentacular circle. Its walls are exceedingly dense, and open superiorly by five motile lips. The buccal cavity is frequently everted as a flat disk, when the tentacles are depressed along the body *f*. For a long time I considered that the polyps were naked and single, as I was unsuccessful in detecting either a connecting polypary or a corallum, while the Zoophyte remained *in situ*, and any attempt to remove it caused the polyps to disappear altogether. Afterwards, the stones on which they grew became coated with fine dust, deposited from the water, and afforded no hold for the creeping polypary; the latter, therefore, floated unattached as tortuous white threads bearing polyps. The polypary was inclosed in a transparent membranous sheath or corallum, which at intervals bore short, cylindrical, even-rimmed cells of unequal length, for the reception of the polyps. This interesting little zoophyte is remarkable for the laxity of its habit, and the extensibility and

transparency of its polyps, arising from the extreme vacuolation of their tissues. When at rest the polyps extend their bodies and tentacles to their utmost length; but a sudden glare of light, or shaking of the vessel in which they are confined, causes the modest hair polyp to contract itself, or to bend the buccal cavity and tentacles loosely downwards, like a flower drooping on its stalk. It seldom entirely withdraws itself into its cell unless irritated.

I have never observed any reproductive apparatus or acaleph-bearing capsules on this zoophyte; and, in default of their appearance, I am disposed to class it with the *Corynidæ* of Johnston; and that on account of the progressive development of the tentacles, which, as in *Coryne*, *Clava*, and *Hydractinia*, become more numerous with the increasing age of the polyp, while in the *Campanulariadæ*, to which I at first referred it, under the name of *C. trichoides*, the growing polyp has its full complement of tentacles when it issues from its opening cell. The polyps of *Trichydra* also differ from those of the *Campanulariadæ* and *Sertulariadæ* generally, in showing no disposition to hold the tentacles in a double row; an arrangement of these organs which has not been sufficiently noticed in the figures and descriptions of authors on these classes.

3. *Tubularia indivisa* will be described under next meeting (see page 263).

4. Description of New Protozoa (see Appendix No. II.).

Wednesday, 22d April 1857.—W. H. LOWE, M.D., President, in the Chair.

The following Communications were read:—

I. *Notes on Scottish Lepidoptera in 1855-56.* By R. F. LOGAN, Esq.

The communication I have to-night to lay before the Society is, as its title imports, rather a collection of scattered notes, than a regular paper. I shall first enumerate a few insects which were added, during the years 1855 and 1856, to the list of species occurring around Edinburgh; principally by the industry and energy of the Messrs Wilson.

The first species on Mr Wilson's list is *Anisopteryx Æscularia*, of which he obtained a single male specimen from Corstorphine Hill, in the spring

of 1855. It is probably frequently overlooked, like many other brumal and vernal species; but does not appear to be common in Scotland. *Eupithecia innotata*.—Of this scarce species the Messrs Wilson obtained one specimen near Morningside in 1855; and have hitherto been unsuccessful in their attempts to find more. The Rev. Joseph Green, in a recent number of the *Zoologist*, states, that he believes the food of the larva to be the ash (*Fraxinus excelsior*); and this is still further confirmed by Mr Crewe, who states, in the *Naturalist*, that he has taken it from that tree. Knoch, however, as quoted by Treitschke, says, that it feeds on the various species of wormwood (*Artemisia Absinthium, vulgaris, et campestris*); living on the blossoms in the month of August, and varying in colour from green to brown.

The curious little *Noctua Euplexia lucipara*, although known to occur in other parts of Scotland, had not apparently been observed near Edinburgh till the summer of 1855; when Mr Wilson obtained a specimen on Corstorphine Hill; and I afterwards found several, in the larva state, on the Pentlands in October, feeding on the common fern or braken, (*Pteris aquilina*). These larvæ formed loose cocoons just under the surface of the earth; and produced the perfect insects in June 1856.

In June and July 1855, *Dianthæcia conspersa* was observed by the Messrs Wilson, at Slateford and Currie; in which localities, they afterwards found the larvæ in August, feeding on the seeds of *Silene inflata*, along with those of the rather scarce *Dianthæcia carpophaga*. From these larvæ both species were reared in 1856; but those of *D. carpophaga* are not easily reared in confinement; and but few moths came to perfection. These are very different in colour from English specimens of the same insect, being much darker, and less ochraceous in tint; and are no doubt a climatal or geographical variety.

The next species I have to mention is *Demas Coryli*, of which Mr Wilson reared one male, from a larva found in the autumn of 1855. During last autumn Mr Wilson and I found nine or ten more larvæ; so that the species does not seem so rare in the district as we had imagined it to be; although certainly less common than in many other parts of Scotland.

In 1856 the Messrs Wilson have added five species to the list. *Lobophora lobulata* was found among sallows near Penicuik in April; and in the same locality in June, *Coremia ferrugata*, and *Coremia propugnata* occurred; both common insects, but not before observed in the district. *Thera variata* was reared in July, from rather short green larvæ, with white lines, found on juniper on the Pentlands in June, along with the larvæ of *Eupithecia Sobrinata*; and on the 8th of October, I beat a specimen of the perfect insect from one of the juniper bushes, apparently indicating the existence of a second brood in the year, as in *Thera simulata*. Finally, Mr Wilson found five or six larvæ of *Clostera reclusa* on *Salix capræa*, in Drumshorling Wood, near Broxburn, in the end of August; they were then full grown; and spun their cocoons in a day or two after they were placed in captivity.

Late in October 1855, when the leaves were rapidly departing from the trees, I found the active, green, fusiform larvæ of *Swammerdamia griseo-capitella*, in abundance on the dwarf birches at Ravelrig Bog, along with the larvæ of *Phlaeodes frutetana*; and forming circular mines in the birch leaves, somewhat like those made in the leaves of apple and pear trees by the brilliant little *Cemostoma scitella*, were a few unknown larvæ of a *Nepticula*, which produced in 1856, *N. argentipedella*, almost at the same time that Mr Stainton bred the species from larvæ collected in England by Mr Wilkinson. At the same time and place, a small larva was found mining in the birch leaves, and finally cutting out an oval case, in which it descended to the ground to complete its transformations. This curious little artificer produced in June, *Tinea bistrigella*—an insect already in our list, but of which the transformations were unknown, until the larva was detected in the south of England in 1855, by Mr Boyd.*

A single specimen of *Scoparia pallida* was taken in the marsh at the west end of Duddingston Loch, on the 11th of July 1856; and on the 24th the larvæ of *Notodonta Ziczac*, *Hypermeia angustana*, and *Chesias Spartiata* were found in the vale of the Heriot; the two former on sallow, the latter on its natural food the common broom.

The remaining species added during the two past seasons are—*Gracillaria elongella*; which is not scarce in many places during the autumn; and must feed on other trees besides the alder. *Lithocolletis Scopariella*, taken at Heriot in July, among broom. *Nepticula* —? reared from mountain-ash, in the spring. *Nepticula anomalella*, mining in the leaves of the Chinese rose (*Rosa indica*) at Duddingston; and previously taken at Balgreen: and lastly, the old mines of *Nepticula Tityrella* have been detected this year, by Mr Shield, in the leaves of a beech hedge, between Threipmuir and Balerno.

Early in May 1856, I bred three specimens of *Eupithecia Helveticaria* of Boisduval, from green larvæ found on the common juniper, on the Pentlands, in the autumn of 1855. I had met with the insect in former years, and suspected it might prove to be a new species. It was not until Mr Doubleday sent specimens to M. Guenée; and thus ascertained that it was already named on the Continent, that I discovered I had overlooked Boisduval's description of the insect, which he says was bred by Herr Anderregg, in Switzerland, from larvæ found on *Juniperus Sabina*. The Messrs Wilson found several of the larvæ on the Pentlands last autumn, some of which, from being kept in the house, produced the perfect insects in the month of February.

Another very interesting species of the genus *Eupithecia*, was found in some numbers, by the Messrs Wilson, although it is not new to the district, having been taken near Edinburgh many years ago by Mr Curtis; and one of its apparent varieties, on several occasions of late years, by Dr Lowe and myself. I allude to the large and handsome *Eupithecia*

* I have some slight doubts as to whether the larvæ found by Mr Boyd are identical with those above mentioned.

cognata. Having fortunately obtained the eggs of *E. subfulvata*, from a worn specimen captured at Duddingston, at the same time that Mr Wilson kindly furnished me with those of *E. cognata*, I have no hesitation in saying, from the results of a careful comparison of the larvæ in all their stages, that they are the same species, and feed on the same plant, the common yarrow (*Achillea Millefolium*). With regard to the other supposed variety, *E. succenturiata*, I can say nothing; as I have not seen the larva, which is said to feed on the seeds and flowers of *Artemisia maritima*. Should it prove to be the same species, the last mentioned, being Linnaeus' name, must be retained for the insect.

In August and September many larvæ of *Eupithecia assimilata* were found at Duddingston, on black currant (*Ribes nigrum*). The insect stands already in our list, and had been bred by Mr Wilson, under the name of *minutata*; but the latter species is said to feed upon heath, and to frequent uncultivated localities, while the former is always found in gardens.

During the autumn of 1855, I received a few eggs of *Coremia olivata* from the neighbourhood of Loch Rannoch: they hatched shortly after I received them, and the young larvæ fed on the different species of *Galium*; passing the winter without feeding, and commencing again early in the spring. The full-grown larvæ were dingy brown in colour, and remarkably hispid, bearing no resemblance to Reaumur's "*Arpenteuse qui vit de feuilles de frêne*." About the same time, Mr Wilson obtained the larvæ of *Coremia munitata* from the egg; but only one survived the winter; it resembled very closely the larva of *C. montanata*.

Having likewise received fertile eggs of *Erebia blandina* from Rannoch, I placed the young larvæ in a glass cylinder, having the upper end covered with a piece of muslin, and the lower end placed in a flower-pot containing several species of growing grasses, and exposed the whole to the weather in the garden. Here I had the satisfaction to perceive that the young larvæ thrived apace; and before the hard weather set in, they were about three lines in length, of the usual form peculiar to the *Satyridi*; and when resting, as they generally did, near the roots of the grasses, they resembled the withered sheaths so closely as to be almost undistinguishable. In this position, five of them survived the winter; but the last of these died on the 19th May 1856; and I have been still more unsuccessful in a second attempt, which I was enabled to make last autumn through the kindness of the Messrs Wilson.

In April 1856, I received, from Perthshire, eggs of *Petasia nubeculosa*, *Brephos Parthenias*, and *Semioscopis Avellanella*—all very interesting species to the systematic entomologist, from the positions they appear to occupy on the limits of the respective tribes to which they belong; each apparently possessing the characters of two of the principal divisions of the Heterocerous Lepidoptera. These involved affinities are fully borne out by the characters of the ova, which have been too much neglected as an aid to classification. Thus, the eggs of the *Petasia* are spherical, and

ribbed, like those of the *Noctuina*; and the young larva, when first disclosed, arches the central segments slightly in walking, like nearly all the larvæ of the *Noctuina*, before their second moult. The eggs of *Brephos Parthenias*, which Guenée places at the end of his first section of the *Noctuina*, are oblong-oval, smooth, and resemble the eggs of most of the *Geometrina*; while those of *Semioscopis Avellanella* are flat and scale-like, indicating a close affinity with the *Tortricina*. The young larvæ of *Petasia nubeculosa* were disclosed from the egg about the middle of May, and were then bluish-gray, with small dark tubercles, and an amber-coloured head. They were very restless at first, and it was some time before they commenced to feed. They changed their first skin in about fourteen days, spinning a silken carpet on the leaf, in which they fastened their prolegs for security of position, and then appeared of a pale green, with three whitish lines, minute black tubercles, and translucent green head; the thoracic feet, and a spot upon each of the prolegs black. They still looped slightly in walking; resting solitarily on the under sides of the birch leaves, with their heads stiffly recurved, like the larva of *Endromis versicolor*; and dropping, when suddenly alarmed, by a silken thread, which they used for the purpose of regaining their position, when the supposed danger was over. In disposition they were most pugnacious and irritable; hitting and biting each other whenever they came in contact, and wandering restlessly about when disturbed. In consequence of these habits, several of them died from the wounds they received from their companions. The second moult was completed in eleven or twelve days, when the black tubercles became pale whitish-yellow. After the third moult, which was again accomplished on the fourteenth day, the young larvæ were pale yellowish-green, the hair-warts sulphur-yellow: an oblique lateral streak on the fourth segment, and a transverse bar on the twelfth segment, of the same colour; head unicolorous green; thoracic feet, and a spot on each of the prolegs black. After this they did not appear to alter much in the succeeding moults, and I was prevented from completing my observations upon these interesting larvæ, by the demise of the last one, before it was full grown; but some of the English entomologists were more successful, and, I believe, obtained the pupæ.

II. *On the Chalk Flints of the Forth.* By Professor FLEMING.

The author stated, that having visited the Black Rocks, Leith, on the 28th ult., at a low ebb-tide, after strong easterly winds, he was surprised to find a large heap of *Chalk Flints*, from which the covering of sand had been removed by ripple action. Similar flints had been observed by Mr Christie of Hawkhill, in a field to the eastward of the house, and the author had detected a single nodule in the brick-clay of Kinghorn. Having previously observed a bed of flints, with angular masses of *chalk*, in the middle of a deposit of brick-clay, on the Aberdeenshire coast, he discarded

the usual notion that the flints occasionally found on the shores of the Forth were the remains of *ship-ballast*, and gave it as his opinion that they were the wreck of cretaceous strata, which formerly existed in the neighbouring sea, and were a prolongation of the Denmark beds.

III. *Observations on British Zoophytes. On Tubularia indivisa.* By THOMAS STRETHILL WRIGHT, M.D., Fellow of the Royal College of Physicians, Edinburgh. (See Plate XV.) (For description of Plate see p. 253.)

The object of this notice is to elucidate some points in the anatomy and physiology of *Tubularia indivisa* which have escaped detection by, or presented difficulties to, the numerous authors who have written on this zoophyte.

This species of *Tubularia*, as many members of the Society are well aware, is common in the Frith of Forth, where it is dredged up from the oyster-beds in considerable quantities. It resembles, as Ellis has remarked, an oat-plant with the straws topped or truncated at from two to eighteen inches from the root, each stem bearing at its summit a single polyp of a white, pink, or rich crimson colour, and furnished with a double row of tentacles. In describing the anatomy of this zoophyte, I shall take the different parts in the order I have observed in my communication on the anatomy of *Hydractinia*, viz.,—1st, the corallum; 2^d, the polypary; and, 3^d, the polyp. The *corallum*, or polypidom, is a simple yellowish chitinous tube, straight or slightly flexuous. It is often divided at the base, so as to form sinuous *quasi* roots, which creep over shells and stones, and occasionally the coralla of other zoophytes, resembling, as Ellis quaintly observes, “the guts of small animals.” Many tubes are often found twisted together by the roots. The tube of the corallum increases in diameter from its attachment upwards, and is marked at irregular distances by wrinkles or annulations. The chitinous substance is brittle, cutting cleanly between the scissors, without splitting, but its illuminating action on the dark field of the polariscope indicates that it is composed of fibres running in a longitudinal direction.

The *polypary*, or that part of the animal which is inclosed within the corallum, presents a structure of great interest.

Johnston describes it as a soft, almost fluid, reddish-pink pulp or medulla, in organic connection with the polyp. Dalyell states that the tube is replete with a yellowish tenacious mucous matter completely occupying the whole, or accumulated in irregular ruddy masses. These naturalists were therefore ignorant of the anatomy of the polypary, though Johnston remarked that the recent stalk was marked by longitudinal pale lines placed at equal distances, which he justly considered were evidences of some peculiar structure in what he termed the interior pulp ; and he inquires, " What is their relation to the currents observed by Mr Lister ?" It is probable that Johnston referred from memory to Lister's discovery of the circulation in *Tubularia*, as the latter writer, in the 124th volume of the *Philosophical Transactions*, clearly describes these lines, and their relations to the currents. He remarks, " when magnified about one hundred times, a current of particles was seen within the tube that strikingly resembled, in its continued steady flow, the circulation in plants of the genus *Chara*. The general course of the stream was parallel to the slightly spiral lines on the tube. On the greater part of the side first viewed, it set as from the polypus ; but on reversing the glass trough so as to show the other side, the flow was there towards the polypus : each current thus occupying half the circumference." " The tube had, between the lines of more conspicuous spots, a granular appearance, and beneath this the currents ran." Dalyell, though he examined a great number of specimens of all sizes and ages, was never able to detect any such circulation, and appears strongly to doubt, although he does not deny, its existence. It certainly is not readily observed in healthy individuals, as the moving fluid is very clear, and generally contains little or none of the granular matter which is carried along by the circulation in most of the hydroid zoophytes. Its existence, however, indicated by the passage of a few flying particles, may be detected in all living specimens, especially in those which have cast off their polyps, and in which the process of the renewal of those organs requires the conveyance of solid matter to them from all parts of the stem. Lister's observations were conducted on a single specimen which he had found thrown up on the sea-shore, and

in which the polyp was in course of being absorbed, and its solid matter stored in the circulating fluid for the production of its successor.

On first obtaining a favourable specimen of *Tubularia indivisa*, I directed my attention to the structure of the polypary, and the phenomena of the circulation within it. I found that each of the spiral lines was generally formed of two narrower lines running close and parallel to each other (Plate XV., fig. 3), and that the circulation took place along the wider interval between the double lines. These intervals had the appearance of canals situated immediately beneath the corallum, and occasionally communicating with each other by cross branches. A thin transverse section of the stalk, readily made by the aid of a fine pair of scissors (Plate XV., fig. 2), showed that (with the exception of a thin layer of "ectoderm" *b*, which lined the inside of the corallum *a*), the whole of the tube was filled with a highly-vacuolated or cellular "endoderm" *c*, having the appearance of the pith in the section of an exogenous plant, and was generally impervious to the passage of fluid. Immediately within the ectoderm, the endoderm was perforated by eight or more equidistant canals *d*, finely ciliated in their interior, and having their walls loaded with coloured granular matter. The interstices between these canals corresponded to the double lines seen in the longitudinal view (fig. 3). As the polypary emerged from the corallum, the tubes became wider, and opened into each other until they formed a single cavity immediately beneath the lower range of tentacles of the polyp; here the circulation became influenced by a mechanical provision, hereafter to be described. The circulation in *Tubularia indivisa*, therefore, as far as relates to the polypary, is carried on by ciliary motion in canals which permeate the periphery of the endoderm in the longitudinal direction of the stem. The movements in the different canals are not related; in some of the canals the fluid is passing upwards, in others downwards, and in others it is at rest, previous to its commencing to flow in an opposite direction.

The polyp of *Tubularia* is distinguished by two rows of filiform tentacles,—the one short and fringing the mouth, the

other long and forming a circle round the base of the buccal papilla. The buccal papilla is striated by crimson longitudinal markings, produced by aggregations of the coloured granular matter of the endoderm, and generally continuous with lines passing upwards from the spiral tubes of the polypary. In healthy specimens, the buccal papilla is constantly slowly dilating, or contracting, and pumping the fluid contained in the polyp backwards and forwards alternately between its own cavity and that which exists below the tentacles, and which, as I have stated, is formed by the anastomosis of the spiral tubes of the polypary. Hence Dalyell has called the polyp the heart of the zoophyte. And one might, though incorrectly, call this the cardiac circulation, and that of the polypary the capillary circulation, of the animal.

In specimens kept in captivity the flower-like polyp generally drops off, and is renewed every four or five days, and at each renewal a ring, sometimes a circular spathe, is formed by the tip of the old corallum, as the corallum secreted by the growing polyp rises up within it. Hence, the length of the interval between the rings indicates the age which has been attained by each successive polyp.

I have already stated that three modes of reproduction occur in Hydroid zoophytes. 1st, Oviparous; 2dly, Larviparous; and 3dly, Polypiparous, in which last the young become developed into complete polyps before leaving the ovarian sac, as in the zoophyte we are now considering.

The female reproductive process in *Tubularia* has been investigated by Baster, Dalyell, and Van Beneden, and their researches have been confirmed by Mummery. The ovarian sacs are attached to stalks which spring from the base of the buccal papilla, above and close to the lower tentacles, and between the crimson striæ, and resemble bunches of grapes hanging down on all sides. They are frequently developed in such numbers, and attain so great a size, as to almost hide the polyp in their clusters. The stem of the cluster, and each of the grape-like ovisacs, is formed of the usual three (ectodermic, muscular, and endodermic) layers, and in each ovisac a single ovum, or sometimes two ova appear, which become developed into perfect

polyps, are extruded from the summit of the ovisac, and fixing themselves by their base, commence the development of a polypary, like the parent zoophyte.

In male specimens, for this zoophyte is dioecious, the spermatic capsules resemble in shape and structure the ovarian sacs of the female, except that instead of ova, we have a gelatinous plasma, secreted between the endoderm and muscular layer, in which spermatic cells, and afterwards spermatozoa, are developed. The spermatozoa of *Tubularia* were discovered by Krohn in 1835. Their existence, of which there is no room for doubt, has since been denied by Van Beneden and Johnston.

IV. *Notice of two Fossils found in a bed of Shale below St Anthony's Chapel, Arthur's Seat.* By JAMES M'BAIN, M.D., R.N.

The short communication which I have to make to the Royal Physical Society has reference to two fossil organisms found in a bed of shale beneath St Anthony's Chapel. This bed rests upon amygdaloidal trap-tuff, and is covered by another bed of columnar basalt, on which the chapel is built. The bed can be traced from a few feet above the old arched well, where it appears as a tough siliceous sandstone, passing upwards for twenty or thirty yards, then following the general bending and curvature of the great beds of amygdaloid and basalt, between which it is intercalated, until it finally disappears under the detritus and soil, at the northern and lower part of the cliff on which the chapel rests. It can be easily traced for fully a hundred yards, and is well exposed in seven or eight places. It has been long known to the geological explorers of Arthur's Seat that this shaly bed contained fossil organisms, apparently of a vegetable character, to which the general term "fucoid" has been applied. These vegetable-looking impressions are found in great abundance in thin layers of shale, of which the bed is formed; but hitherto, so far as I am aware, without any special characteristic marks by which they could be assigned to any particular geological epoch. To facilitate the investigation of the contents of this bed, one of the before-mentioned exposed places was opened to some extent in June 1854. On visiting the spot a few days afterwards, and chipping a portion of the thin laminated clay, I found a small tooth imbedded in it. The length of the tooth was about seven-tenths of an inch; its form curved, pointed, and marked by longitudinal striae, diverging from the central axis at its base. On showing the tooth to Professor Fleming, and comparing it with specimens in his collection of fossil fishes, he had little doubt but that it belonged to the genus *Holoptychius*—most probably to the *Hol. Hibbertii*—a fossil fish found abundantly in the Carboniferous system, and

especially in the fresh-water or estuary group of that system known as the Burdiehouse limestones. This tooth, imbedded in its matrix of fine laminated clay, was given to the late Professor Edward Forbes, who attached much importance to the discovery. He expressed a desire to have it thoroughly identified by the best authority on fossil fishes, and it was to have been sent to England by him for that purpose a short time before his death. I am not aware whether it was sent, or what has now become of it. It was in the hope that this specimen might have been found amongst those left by Professor Edward Forbes to the Museum of the University of Edinburgh, that I delayed making public notice of this discovery to the Royal Physical Society. The assistant-conservator of the University Museum (Mr Davies) has carefully searched the collection of Professor Edward Forbes without being able to find our specimen. It is therefore unlikely that this fossil tooth will now be forthcoming. The other fossil organism evidently belongs to the vegetable kingdom. Several specimens have been found, but they all appear to be mere fragments. The few specimens which I have kept are very poor representatives. Short spines can readily be observed on some of the fragments; but I find a difficulty in deciding whether they have originally been verticillate, opposite, or alternate on the stem. The distinctness of their general outline may furnish, however, a tolerably safe guide for comparing them with a complete series of other fossil plants by which their geological position may be inferred. The nearest resemblance to these specimens which I have seen figured in plates is that of *Bechera charæformis*, accompanying the Memoir of Mr Joseph Prestwick, "On the Geology of the Coalfield of Coalbrookdale," from the Transactions of the Geological Society of London, vol. v. for 1840. The lithological character of the shale bed in which these organisms occur is chiefly composed of thin layers of fine clay and earthy greenstone, containing variable proportions of siliceous and calcareous materials. The vegetable impressions are seen in great abundance, lying parallel to the plane of the sedimentary deposition of the several layers, six of which can at least be observed, from one to six or eight inches in thickness, indicating a quiescent and intermittent condition of the carrying power which brought and assorted these materials into their present position. Other parts of Arthur's Seat, having reference to fossil remains, have been carefully examined, but, so far as I know, as yet without success. At the Windy Gowl, on the south side of the hill, on the road to Duddingston, under what Mr Maclare, in his excellent work, "The Geology of Fife and the Lothians," calls the Girnal Crag, there is a bed of hard cherty limestone, covered by the bed of sandstone on which the porphyritic greenstone bed of the crag rests. This limestone bed I have repeatedly examined, but without finding a trace of fossil remains. The Girnal Crag is considered by Mr Maclare and other competent geologists to be the equivalent of Bog Crag, the first on the east rising from the hollow termed the Hunter's Bog, on the north side of the hill. Under a portion of Bog Crag, presenting an example of what is called a

"crumpled surface," near the washing well, a bed of sandstone, containing a large proportion of lime, is partially exposed, but not sufficiently so to determine on what bed this calcareous sandstone rests. The Crag to the eastward of Girnal Crag at Windy Gowl is termed by Mr Maclaren the "Loch Crag," and is considered by that geologist and others to represent the Well Crag on the north side, the next rising above the Bog Crag, and upon a portion of which the fossiliferous shale-bed is situated. Overlying the compact greenstone of Loch Crag is a bed of amygdaloidal tuff, very similar in character to that on which the fossiliferous shale rests. Professor Fleming and myself, when tracing this crag upwards towards the summit of the hill, met with masses of limestone, neither rounded nor water-worn, and evidently *in situ*, but destitute of organic remains. Vegetable fragments, similar to those now described, were found by Professor Fleming and myself, in the sedimentary beds of sandstone and shale, behind the Royal Terrace, overlying the concretionary clay porphyry or argillite of the Calton Hill. It is not necessary for me to enlarge upon the importance of the presence of fossils in any formation or group of rocks in regard to geological questions; but their importance is peculiarly valuable in connection with formations of what are termed "igneous origin." Professor Fleming's attention has been long engaged in this important inquiry; and in a paper read before the Royal Society of Edinburgh, in the winter of 1855, "On the Geology of the Calton Hill, and Sedimentary Trap-Rocks in the Neighbourhood of Edinburgh," he has brought forward abundant proofs that the "theories" hitherto generally adopted are not in accordance with the facts observed. I have reason to believe that this investigation will be continued, that it will include the geology of Arthur's Seat, and that we may soon expect to be put in possession of his entire views on this question.

Lieutenant Thomas, R.N., exhibited several small star-fishes, which he considered as new. They were dredged up in 1848 from fifty fathoms water, with stony bottom, half way between Fair Isle and the Orkneys. The star-fish displayed both ventral and dorsal openings; and were handed over to Dr Greville, who kindly undertook to examine them.

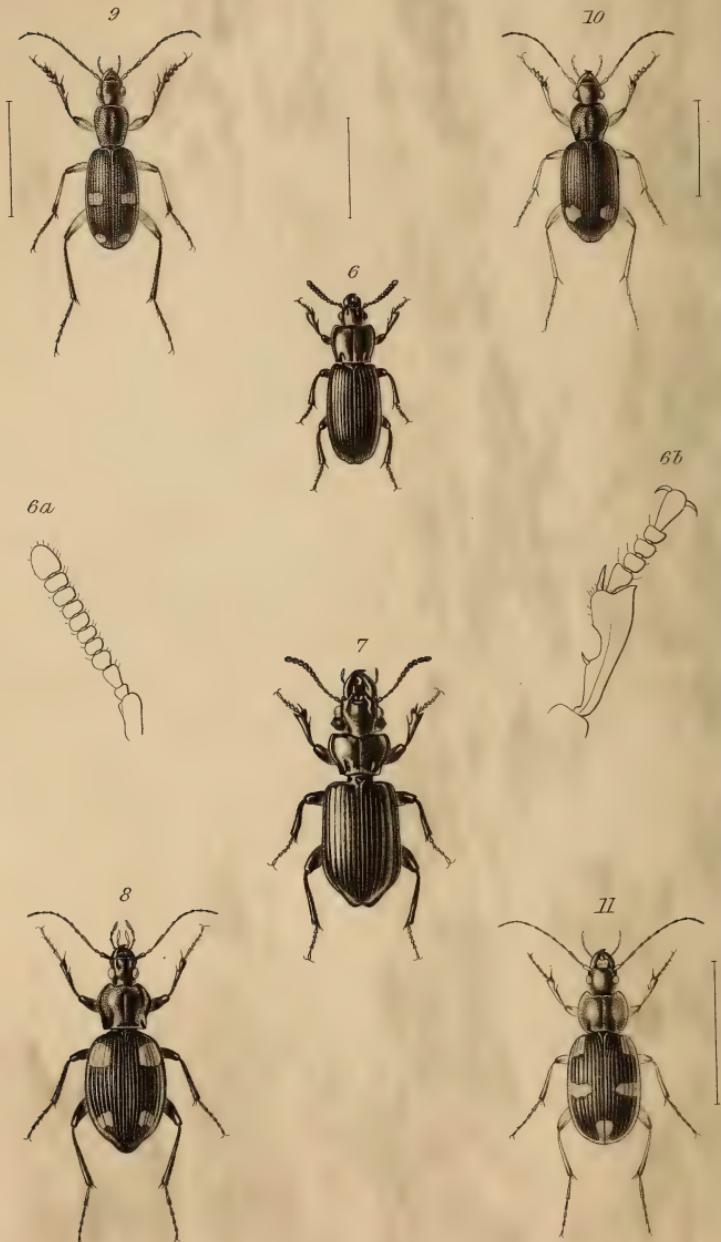
Mr George Forrest exhibited the skin of an otter, *Lutra vulgaris*, apparently a young female, which was killed in a small burn near Peffer Mill in December last, during a severe frost, Duddingston Loch being frozen over. There were three otters seen together, but the others escaped. It measured three feet two inches from snout to point of tail, and weighed 9 lb. 8 oz. Mr George Logan, W.S., stated that, some time afterwards, a family, apparently of no less than five otters, had been observed again and again fishing in Duddingston Loch, and a few years preceding two full-grown specimens were captured alive, ascending the burn towards the loch at Duddingston Mills.



Migneaux pinxit

Lebrun sculp.

1. *Lebia clavigeris.*2. *Raphidognatha trimaculata.*5. *Scarites Ajax.*3. *Belonognatha quadrimaculata.*4. *Scarites Hercules.*



J. Mignaux pinxit.

Lebrun sculp^t.6. *Stereostoma Whitei*.9. *Chlaenius elongatus*.7. *Platynodes Westermanni*. Westw.10. — *Chevrolati*.8. *Panageus grossus*. Hope.11. — *diaphanicollis*.

APPENDIX

TO SESSION 1856-7.

List of Coleoptera received from Old Calabar, on the West Coast of Africa. By ANDREW MURRAY, Edinburgh.

[Read 26th Nov. 1856. See p. 222 *ante.*]

PART I.

A PART of the West Coast of Africa, about the natural productions of which we know less than of many other parts of the coast, has within the last few years been opened up to us by the establishment of a mission station at Old Calabar. This station has been established by the United Presbyterian Church of Scotland; and most fortunately for science, the missionaries and their assistants who have been sent there, have been not only able and diligent in their proper calling, but also intelligent and observing men, who have availed themselves of their position to make and transmit to this country collections in different branches of natural history. The gentlemen I allude to are the Rev. Hope M. Waddell and the Rev. Mr. Goldie, Mr. W. C. Thomson and Mr. John R. Wylie. From all of these gentlemen collections have been received, from which I have profited, and which have put me in the position of being able to form something like a catalogue of the Coleoptera of that country. I think I may with justice say, that from these sources I possess a larger amount of materials for making up such a catalogue than any other person; and as a great number of the species are new and curious, and the whole are specially interesting in

relation to the geographical distribution of species, I propose to give a list of all which I have received, intercalating descriptions of those which are new, with figures of the most striking. I shall have my labours in this respect a good deal curtailed by some of our most eminent entomologists, who are working at Monographs of particular groups. To them I have thought it right to entrust the new species in each of their departments; and these have either been already described and published, or are in course of being so. M. Chevrolat has described about a hundred of the new *Longicorns*; M. Boheman in his Supplement will describe between twenty and thirty new *Cassidae*; Mr. Westwood occupies himself with the new *Megalopidae*, and M. Suffrian has already published the new *Cryptocephalidae*. The new *Elateridae* are in the hands of M. Candeze, the first volume of whose work on that great family is already in the hands of entomologists.

I am very sensible that in the following pages I shall unavoidably occasionally fall into the error of describing as new, species which have been already described by other authors. The immense number of descriptions of species scattered through foreign Journals and Transactions of Societies, renders it hopeless to expect to escape such mistakes. I see the ablest and best-informed entomologists, both at home and abroad, constantly falling into them, and I am not so unreasonable or self-confident as to expect a better fate. All I can say is, that when I do commit such errors, they are made "not in consequence of neglect, but in spite of attention."

That such errors are not much more numerous than they will be found to be, is greatly owing to the kindness of my friends, Mr. Adam White of the British Museum, MM. Chevrolat and Reiche of Paris, and Herr Dohrn of Stettin, who have on every occasion laid freely open to me the extensive stores of information which they possess,—an assistance the value of which only those who have been engaged on similar works can justly appreciate.

I have not attempted to make this a work of synonymy, but in recording the species which have been already described, I have simply confined myself to giving their names, with one reference to the place where a description will be found; and while I have endeavoured to follow the rule of priority in selecting the name of the species, I have by no means followed that rule in choosing the reference to the description (the oldest descriptions being generally the most insufficient), but I have chosen that which appeared to me the best and was at the same time most generally accessible.

Cicindelidæ.

CICINDELA, Linn.

1. *C. Senegalensis*, Dej. 1. 117.

Capite thoraceque viridi-cupreis, subrugosis ; elytris viridi-æneis ; marginè laterali, lunula humerali apicalique, fascia media obliqua sinuata suturaque subsinuata abbreviata, albis.

Long. $4\frac{1}{2}$ lin., lat. $1\frac{1}{2}$ lin.

Only a few specimens have been received of this species. They vary a little from the usual form of *Senegalensis* in having the thorax comparatively a little narrower, and the ground-colour of the elytra being less green, it being reddish-brassy with green reflections ; but the markings are the same, and it corresponds in other respects ; therefore I have no doubt it is merely a variety of *Senegalensis*.

2. *C. vicina*, Dej. 5. 244.Var. *confusa*, mihi.

Subcylindrica, supra cupreo-viridi ænea ; elytris margine laterali subinterrupto, lunula humerali subinterrupta, altera apicis dentata, strigaque media recurva subinterrupta incumbente, albis ; femoribus subtus rufis.

Long. 4-5 lin., lat. $1\frac{1}{3}$ - $1\frac{3}{4}$ lin.

The specimens I have from Old Calabar differ slightly from my other specimens of *vicina*, Dej., but not sufficiently to constitute a distinct species. The labrum is more prominent in the Old Calabar specimens, but that part varies a good deal in form, and particularly in the development of the three teeth in front. In the males they sometimes appear almost entirely wanting. The first joint of the antennæ in *vicina*, Dej., is green. In the Old Calabar species this joint is either wholly brown, or brown below with a virescent tinge above. The white marks on the elytra are broader in *vicina* than in this variety, and its apical margin of white slopes somewhat parallel with the margin, while in this variety its upper edge is nearly square or parallel with the base ; but the breadth, extent and form of the white markings on the elytra vary a good deal in different individuals.

I obtained a specimen identical with my Old Calabar examples from M. Jekel, under the name of *confusa*, Gehin ; but I have not been able to ascertain that it has been anywhere described

by M. Gehin, whence I presume it is a MS. name, which I have preserved for the variety. M. Jekel's ticket bore "*melancholica*, Fab. non Dej." as a synonym; but I know not on what grounds this statement was made.

Var. *obliterata*, mihi.

I have two specimens which I also consider as a variety of the above. The white markings on the elytra have here greatly diminished, so that the humeral lunule and middle band have disappeared, leaving only a white spot where they terminated; the distinct white margin has also been attenuated to an interrupted thread along the margin, and it is very little broader at the extreme apex. A more important distinction is that the granulations or punctuations on the thorax are much finer than in the var. *confusa*, in which they are coarse.

3. *C. Lowei*, mihi.

Capite thoraceque obscure cupreis; elytris obscure viridi-aeneis; margine laterali intus tridentato, punctis duobus apicem versus albis.

Long. $5\frac{1}{4}$ lin, lat. 2 lin.

Closely allied to *C. Luxerii*, Dej. Dejean's description of *Luxerii* applies to this species, with the following exceptions:— This is rather larger, being $5\frac{1}{4}$ lines in length instead of only $4\frac{1}{2}$, and proportionately broad. In *Luxerii* there are two small oblique whitish spots, near to and parallel with the angular sides of the scutellum, which are wanting in this species; a longish tear-shaped white spot alongside of the suture, distant from the base about $\frac{1}{3}$ rd of the length of the elytra, is also wanting here. In *Luxerii* there is an oblique triangular spot near the apex, in some examples connected with the margin by a slender band, showing that this is merely a part of an interrupted hooked band. In *Loweii* this spot is confined to a small round or thread-like dot. The white margin is a good deal broader than in *Luxerii*, and a blackish violet-coloured edging on the outer side of the white margin is more conspicuous than in that species. The greater extent of the interior obscure space and the want of the small white spots in the middle and towards the base of the elytra, readily distinguish this species from *Luxerii*.

I have received four specimens, all of which are constant in the above characters.

I have named this species after my valued friend, Dr. William

Henry Lowe of Balgreen, a naturalist of great ability and acquirements.

4. *C. cincta*, Fab., Dej. 1. 40.

Supra obscura, subitus viridi-cyanea ; elytris vitta laterali, punctisque quatuor albis.

Long. $7\frac{1}{2}$ lin., lat. $2\frac{1}{2}$ lin.

A good many specimens of this species have been received ; but as it comes in some consignments and does not occur at all in others, it is obviously an insect found at particular seasons only. What these seasons are we have yet to discover.

5. *C. interstincta*, Schön., Dej. 1. 42.

Supra fusco-aenæa, elytrorum puncto baseos, fasciis tribus interrupitis, lineolaque apicis albidis.

Long. $7\frac{1}{2}$ lin., lat. $2\frac{1}{4}$ lin.

Carabidæ.

TEFFLUS, Leach.

1. *T. planifrons*, mihi.

Niger ; fronte depresso et plano, thorace rugoso ; elytris sulcatis, sulcis elevato-punctatis.

Long. 21 lin., lat. 8 lin.

Very similar to *T. Megerlei*, Dej., but a narrower insect ; the thorax more particularly is narrower and proportionately more elongate. It is at once distinguished from *Megerlei* by the sculpture on its head. *T. Megerlei* has two deep foveæ on each side of the head between the eyes, and the space between is raised into a height or bump ; a deep transverse depression, widest and deepest in the centre, separates the head from the *clypeus*, which has a couple of longitudinal grooves on its surface ; another transverse depression separates the *clypeus* from the *labrum*. In the present species these depressions and elevations are, with the following exceptions, not visible. The head looks as if a heavy roller had passed over it, smoothing or crushing down all inequalities. The whole head is a flat opaque surface, with the exception of the transverse division separating the *labrum* from the *clypeus*, and the *clypeus* from the rest of the head, and of a couple of oblique lines (they can scarcely be called grooves) tending inwards from the side of the eye. Another difference is observable in the sulcation of the elytra ; but

as this may be variable, I do not insist so much upon it. In my specimens of *T. Megerlei* the sulcation is as follows:—the first sulcus next the suture comes down to the apex alone; the second is joined before it reaches the apex by the fourth, and encloses the third; the fourth again joins the sixth, enclosing the fifth; and the seventh comes down alone.

In the present species, on the other hand, the first, as in *Megerlei*, comes down alone; but the second, instead of joining the fourth and enclosing the third, joins the sixth; then within these the third and fifth join, and enclose the fourth. Trifling variations in the decidedness with which these junctions take place may however be seen on different elytra of the same insect.

I have received two specimens of *planifrons*. On receiving the first, I was disposed to look upon it as a variety or distortion of *Megerlei*; but as I found the same characters occurring in the second, this does not appear to be the case. These characters, more particularly the levelling of the head, which is very marked in both of my specimens, enable us at once to distinguish them from *Megerlei*.

Galeritidæ.

DENDROCELLUS, Schmidt-Goebel.

1. *D. pectoralis*, mihi.

Viridis; ore, pectore, antennis pedibusque rufis; geniculis atris vel fuscis.

Long. $6\frac{1}{2}$ lin., lat. $1\frac{3}{4}$ lin.

The colour above is a decided green, without the blue tinge of *emarginata*, Fab. The labrum, mandibles, palpi and antennæ are rufous, the tips of the mandibles and the end of the first joint of the antennæ becoming fuscous or blackish. There is no blackish ring on the second and third joints, as in *emarginata*. The under side is of the same colour as the upper, with the exception of the breast (*mesothorax* and *metathorax*), which is rufous. The head is oblong-square, extending two-thirds of its length before the eyes, which are not very prominent; it is deeply and distinctly punctured, somewhat shining on the disk. The thorax is very narrow, elongate, deeply and closely punctured, and pubescent; it is slightly narrowed in front, and a little more so behind; its greatest breadth is about the middle. At first sight from above, it looks as if it were cylindrical, but on being examined from the side, a narrow ridge is seen to run

along, forming the margin of the thorax. An indication of a longitudinal line, and of a fovea in the middle of the base, may be traced from the disposition of the punctuation, but nothing more. The elytra are twice as broad as the thorax, elongate, convex, contracted by a sinuation a little behind the base, and widened out posteriorly; their extremity is obliquely truncate, and the truncation is somewhat cut-in on each elytron; they are pubescent and strongly punctate-striate; the intervals are somewhat raised and irregularly punctate; the three outer striae and intervals are curved inwards at the apex and reach the suture, cutting off the inner striae, so that they do not reach the termination of the elytra. The legs are rufous, with the exception of the ends of the thighs, which are fuscescent or blackish; claws of tarsi pectinate.

This species approaches nearest in form to *Drypta cyanea*, Buq., but is readily distinguished by the red breast, red legs, &c., parts which in *cyanea* are wholly black. It is of a more elongate form than *Drypta emarginata*, Fab., and one-half longer; its colour wants the bluish tinge of *emarginata*, and the form of the thorax is different.

GALERITA, Fab.

1. *G. femoralis*, mihi.

Nigra, pilosa; antennarum articulo primo femoribusque ferrugineis; thorace oblongo-cordato; elytris sulcatis, interstitiis concavis, subtilissime transversim rugosis, pilosis.

Long. $10\frac{1}{2}$ lin.; lat. $3\frac{1}{2}$ lin.

Black, with the exception of the first joint of the antennæ and the thighs, which are ferruginous; the end of the terminal joint of the palpi is slightly ferruginous. The antennæ are pilose, which causes them to look fuscous towards the apex. The head is rather large, elongate, punctate, pubescent, and has two longitudinal irregular foveæ between the eyes. The clypeus has one or two punctures on its anterior margin. The thorax is broader than the head, though not very much so; it is of an elongate-cordate form, rounded in front, a little narrowed posteriorly; its posterior angles are projecting and slightly raised; the projecting angles are rounded. It is somewhat convex, punctate on the disk, and transversely rugose-punctate along the margins; it has a slightly marked medial longitudinal line, and a longitudinal depression along each side parallel to the margin. The front of the thorax is emarginate,

the base is cut straight. The elytra are oblong, widened behind ; each has nine longitudinal raised lines ; the interstitial spaces are concave hollows, and under a strong lens they are found to be very finely transversely strigose, and covered with numerous scattered papillæ, from each of which arises a hair. The apex of the elytra is truncate, slightly sinuate towards the suture, which has a tendency to project ; the under side is of the same colour as the upper, with the exception of the trochanters and thighs, which are ferruginous. The tips of the thighs are black. The pilose pubescence on this as well as the other species appears to be easily rubbed off.

This species comes very close to *G. Africana*, Dej., but is distinguished by the thighs and first joint of the antennæ being red, while in *Africana* they are black. The thorax is also somewhat more elongate.

2. *G. gracilis*, mihi.

Nigra, pilosa, elongata ; thorace elongato-cordato, fortiter rugoso-punctato ; elytris sulcatis, interstitiis concavis.
Long. 9½ lin., lat. 3 lin.

Not to be distinguished from *G. Africana*, Dej., except by a comparative description. It is smaller and more elongate ; the thorax is proportionally narrower and more elongate ; the anterior angles are less rounded, sloping forward to the head more gradually ; the head is more deeply punctate, and the thorax more deeply rugose-punctate. The clypeus has the front and anterior margins reflexed ; the centre of the front of it is raised, so as to leave a fovea on each side of the anterior margin. Like *Africana* it is wholly black, with fuscous or ferruginous hairs beneath the tarsi. The tarsi are more elongate than in *Africana*.

3. *G. interstitialis*, Dej. 5. 295.

Nigra ; thorace cordato ; elytris sulcatis, interstitiis concavis, bilineatis, subtilissime transversim striatis, pilosis.
Long. 9½ lin., lat. 3 lin.

Helluonidæ.

MACROCHEILUS, Hope.

1. *M. (Helluo) grandis*, Dej. 5. 400.

Ater ; labro suborrecto, lœvigato ; elytris elongatis, sulcatis.
Long. 12½ lin., lat. 4 lin.

ACANTHOGENIUS, Reiche.

1. *A. (Helluo) bimaculatus*, Dej. 5. 402.

Acanthogenius bisignatus, Reiche, Ann. Soc. Ent. France, ix. 334*.

Ater, punctatissimus; labro rotundato, lævigate; elytris striatis, macula media rotundata pallide flavo-testacea; tarsis rufo-piceis.

Long. 6 lin., lat. 2 lin.

Brachinidæ.

PHEROPSOPHUS, Solier.

1. *Ph. (Brachinus) marginatus*, Dej. 1. 309.

Capite testaceo, puncto verticis nigro; thorace testaceo, margine antico posticoque nigris; elytris costatis, nigris, subparallelis, puncto humerali, margine laterali, fascia media dentata abbreviata, apice, antennis pedibusque testaceis.

Long. 7-8 lin., lat. $2\frac{3}{4}$ lin.

2. *Ph. minor*, mihi.

Capite testaceo, vertice et postice nigro; thorace supra nigro, vel nigro cum macula marginali testacea, subtus nigro, margine testaceo; elytris costatis, nigris, postice latioribus, interdum puncto humerali testaceo, interdum sine puncto humerali, cum macula media testacea dentata, apice leviter testaceo; pectore testaceo; abdomine nigro; antennis pedibusque testaceis.

Long. $6\frac{1}{4}$ - $4\frac{1}{2}$ lin., lat. $2\frac{1}{4}$ -2 lin.

The smallest species of *Pheropsophus* with which I am acquainted. Head and mouth testaceous, with the vertex and back part black, smooth in front, with a shallow depression on each side, faintly corrugated behind. Antennæ long, reaching to the middle of the elytra, fusco-testaceous, a little more dusky towards the tip. The upper side of the thorax is black, but

* Dejean's name *bimaculatus* has been changed by M. Reiche, as above noted, into *bisignatus*, on the ground that M'Leay had previously occupied the name in the allied genus *Planetes* by his species *Planetes bimaculatus*. But I think this is carrying the dread of a double employment of names to an excessive extent. *Planetes* is recognized as a good genus, distinct from either *Macrocheilus* or *Acanthogenius*, and a repetition of the same specific name in each does not seem to entail any great inconvenience —certainly none so great as that of changing a well-known and established name.

sometimes a transverse testaceous blotch shows itself on each side of the thorax ; it is smooth and impunctate, but some small depressions may be seen irregularly occurring along the margins ; it has a deep longitudinal mesial line, scarcely extending to the front or base, and deepest where it joins the curved line in front ; some wrinkles run off transversely from it. Elytra with nine strong smooth shining longitudinal ribs (counting the sutural and marginal ones), the spaces between the ribs covered with short longitudinal strigæ ; black, with a transverse irregular testaceous-yellow spot a little before the middle of each elytron ; the spot varies in size and form ; it has usually a tooth or sometimes two projecting behind, and a larger prominence projecting in front. There is also another small spot of the same colour on the shoulder, but this is sometimes absent ; and in such cases the spot in the middle is exceedingly reduced in size, so much so, that I should not be surprised to find individuals with the elytra wholly free from spots ; but I have not seen any such. The extreme apex of the elytra has a narrow edging of testaceous colour, which extends forwards a very little way on the ribs. Looking carelessly, it would appear as if it were the ribs which gave the slightly yellow tinge to the extremity of the elytra ; but the extreme margin of the apex is itself testaceous. The portion of the upper side of the abdomen projecting beyond the elytra is deeply punctate, black, with a tracing of yellow round the margins of the segments. The under side of the head is testaceous yellow ; of the thorax black, more or less encroached upon by testaceous yellow ; there is usually a testaceous line along the middle, and another along each side next the edge, but sometimes almost the whole under side of the thorax is yellow. The mesosternum is yellow ; the rest of the breast is black, with the exception of a portion of the sides. The legs, the trochanters, the joints, and parts from which they spring, are yellow ; the thighs are all slightly tipped with fuscous, more or less dark. The segments of the abdomen are black, with the exception of the middle of the posterior margin of the first segment, which is yellow when exposed.

Lebiidæ.

CALLEIDA, Dej.

1. *C. ruficollis*, Fab., Dej. 5. 185.

Thorace, pectore, ano, antennarum femorumque basi, tibiisque quatuor posticis rufis ; elytris viridibus ; capite, abdomine, antennis pedibusque nigricantibus.

Long. $4\frac{1}{4}$ lin., lat. $1\frac{1}{4}$ lin.

LEBIA, Lat.

1. *L. bicolor*, Dej. 5. 366.

Rufa; elytris subsulcatis, viridi-cyaneis; geniculis nigris.
Long. $4\frac{1}{4}$ lin., lat. $1\frac{3}{4}$ lin.

2. *L. bis-binotata*, mihi.

Rufo-testacea; elytris striatis, nigris vel nigro-brunneis, mar-
gine reflexo, puncto humerali, et quatuor maculis dorsalibus,
duabus anterioribus magnis, duabus posterioribus minoribus,
luteis.

Long. $4\frac{1}{2}$ lin., lat. $1\frac{3}{4}$ lin.

Nearly of the same form as *L. bicolor*. Rufo-testaceous; the elytra very dark umber, almost black, with the reflexed margin, a humeral spot connected with the margin, one large roundish spot on the anterior portion of the disk of each elytron, and a smaller roundish spot on each side of the suture near the apex, pale testaceous; the posterior spots placed closer together than the anterior. Antennæ filiform, with the three basal joints testaceous, the third darker at the base, the remaining joints dusky and pubescent, the last joint paler at the apex. Head ferruginous, longitudinally strigose in the middle; the strigations tending obliquely to the centre; two faint depressions in front; elyptus smooth; the parts of the mouth rufo-testaceous; tips of mandibles darker; eyes prominent (though not quite so much so as in *L. bicolor*). Labrum moderate, broader than long, slightly rounded in front. Mentum toothed*. Thorax rufous in the middle, the margins pale and transparent, broadly reflexed; mesial longitudi-

* As is observed by Prof. Lacordaire (*Genera des Coléoptères*, i. 127), there is considerable difference of opinion among authors, whether in the genus *Lebia* the mentum has a middle tooth or not; Bonelli, Chaudoir, and others maintaining that it has; while Schiödte, Schmidt-Goebel, and Lacordaire himself are of opinion that it has not,—viewing the piece which is supposed by the former to be a tooth, as a semi-corneous plate which forms the central base of the ligula, and, in dissecting the head, is often taken off attached to the mentum, but is separable from it. That it is so in some instances, there is no doubt; as, for instance, in *Lebia crux minor*. In other cases there is no appearance of a tooth at all, either as forming part of the mentum or the base of the ligula. *Lebia scapularis*, and other North American species, are examples of this. On the contrary, in certain species, as the present, the tooth appears distinctly to form part of the mentum, although it thins off and becomes semitransparent at the edges, the harder texture running up its middle continuously from the rest of the mentum. The truth is, that there are several forms of the mentum among the species which at present are ranked in this genus, and it should probably be broken up into two or three sections. In that case, the present and the following species would fall under different heads.

nal line distinct, but not deep nor sharply defined; disk transversely wrinkled, a transverse depression along the produced part of the base. Scutellum testaceous, elongate-triangular, with a semilunar depression. Elytra broad, truncate and emarginate at the apex, deeply striate, with faint traces of punctures in the striæ, most easily seen in the pale spots, with two larger punctures in or alongside of the third stria, one occurring in the larger pale spot, the anterior margin of which is distant from the base about a fourth of the length of the elytra, the other in the posterior small pale spot, the posterior margin of which is distant from the apex about an eighth of the length of the elytra; a row of larger circular punctures, with a slight elevation in the middle of each, runs along or between the two striae next the margin; the third and fourth, and the fifth and sixth striae show a tendency to unite at the apex, and the seventh turns in at the apex and runs towards the suture, terminating opposite the third stria in a large circular puncture with a central elevation; the eighth and ninth striae also turn towards the suture at the apex, but are speedily effaced. The suture is testaceous at the base, and slightly so along its edge the whole way. The testaceous spot on the shoulder does not encroach on the elytra so far as the point of the scutellum; the testaceous reflexed margin does not reach to the apex; the larger testaceous spot extends across four interstices, commencing at the second stria; the smaller spot extends across three interstices, commencing at the first stria. The under side is pale testaceous yellow, shining, with a few scattered punctures on the segments of the abdomen, from which spring hairs; the legs are of the same colour; claws pectinate.

3. *L. clavicornis*, mihi. Pl. XVI. fig. 1.

Convexa, tumida, læte carnea, semitranslucens; antennis compressis, apicem versus incrassatis, nigris, ferrugineis ad basin; elytris leviter striato-punctatis; pedibus concoloribus; geniculis, apicibus tibiarum atque tarsis nigris.

Long. $5\frac{1}{4}$ lin., lat. $2\frac{1}{2}$ lin.

Semitransparent; body shining, and, when fresh, of a beautiful bright flesh tint, both above and below; after being kept some time it loses its colour, and fades into a clear ferrugineo-testaceous or pale fawn-colour. The antennæ have the first three joints, the base of the fourth, and the tip of the last of the same colour and semitransparency, the remainder deep black, opake, and pubescent; the first three joints are slender and nearly cylin-

dric; the fourth increases in breadth as far as the ferruginous colour extends, it then suddenly becomes straight and compressed, and the two sides run parallel to each other; the remaining joints are in like manner compressed, and the sides parallel; each of them is very slightly broader than the preceding, but the slender joints at the base, compared with the broader remainder, give the antennæ a decidedly claviform appearance; a groove runs up the middle on each side of the flat joints; the two last joints of the maxillary palpi and the apex of the mandibles are a little deeper in colour than the rest of the body. The head is smooth, with a very slight depression on each side in front. Clypeus rather projecting. Labrum moderate, broader than long, straight in front. Mentum without a middle tooth. Thorax with sides strongly reflexed, and with a dorsal channel and some slight wrinkles across the disk; the production of the posterior margin in the middle not so prominent as in some species. Elytra very convex and swollen, having much the form of the elytra in *Lia*, smooth and shining, and with nine rows of slender striae, besides the commencement of a short sutural stria at the base, all slightly but distinctly punctate; interstices impunctate, but with two large and deep impressions on the inner side of the third stria, the one a little more than a fourth of the length of the elytra from the base, and the other about a similar distance from the apex, and near the margin a row of round impressions running along the interstice between the eighth and ninth striae, and one opposite the end of the third stria, each impression having a raised point in the centre; the apex of the elytra is broadly truncate, the truncation sinuate. From the semitransparency of the elytra, the impression of the folding of the wings below is seen, occasionally giving the appearance of something like a device on the elytra, but in reality they are concolorous. The scutellum is elongate-triangular. The under side is smooth and shining; the legs a little darker in colour than the body, with the apex of the thighs, the apex of the tibiae and the whole of the tarsi black or piceous black; penultimate joint of tarsi deeply lobed; claws pectinate.

The much-swollen elytra and the almost claviform antennæ of this species at first induced me to think that it might properly be made the type of a new genus; but as in all other respects it agrees with *Lebia*, as at present defined—unless perhaps that the terminal joint of the palpi is almost ovular, while in *Lebia* it is truncate—I have not been able to justify to myself such a separation, these being points on which we find gradations existing in a greater or less degree among the different species of *Lebia*.

Pericalidæ.

RHAPHIDOGNATHA, mihi (*ραφίς* and *γνάθος*).

Corpus depresso. Thorax postice obtuse-truncatus. Mandibulæ projicientes. Labrum porrectum. Maxillæ apice subuliformes. Antennæ breves, filiformes, leviter compressæ, articulo secundo vix tertio breviore. Mentum sine dente medio. Paraglossæ ad ligulam junctæ. Oculi prominentes. Tarsi articulo quarto simplici. Ungues non pectinati. Elytra basi quadrata, vix thorace latiora, lateribus parallelis vel subparallelis.

This new genus has more the aspect of one of the *Lebiidæ* than of the *Pericalidæ*, but the porrect labrum and ligula enveloped by the paraglossæ show that it belongs to the latter. I place it at the commencement of the *Pericalidæ*, following *Plotchionus* (the last genus of the *Lebiidæ*).

I. *R. trimaculata*, mihi. Pl. XVI. fig. 2.

Brunnea, nitida; elytris striatis, striis leviter punctatis, singulis macula testacea basali, conjunctis macula testacea apicali communi.

Long. $3\frac{3}{4}$ –4 lin., lat. $1\frac{1}{2}$ lin.

Flattish and depressed. Chestnut-brown, shining; base of antennæ, mandibles and other parts of the mouth, margins of thorax and elytra, tibiæ and tarsi, somewhat paler; clypeus large and smooth; labrum smooth and projecting, emarginate in front, fringed with hairs; upper side of mandibles longitudinally striated alongside of labrum. Head deeply and longitudinally wrinkled on each side in front; vertex also somewhat wrinkled; not wrinkled behind the eyes. Antennæ not so long as head and thorax; all the joints very nearly of the same length, except the second, which is a little, but not much, shorter than the others; also all nearly of the same thickness, except the first, which is a little thicker; the fourth and following joints are slightly compressed; and, viewed on the flat side, the antennæ appear slightly thickest about the middle. Thorax transverse, rounded on the sides, widest a little before the middle, narrowest behind; anterior angles prominent and rounded; posterior angles obtuse, except at the extremity, which is very slightly excised on the exterior side; the base is obtusely truncate; margins broadly reflexed, most so behind, and rugosely punctate; there is a slight, narrow, but distinct dorsal line, not reaching to the anterior margin, but stopping at the anterior circular depression. Elytra flat, about three times the length of the thorax, and

a little broader than it ; base straight, and sides nearly parallel, widening very slightly before the apex, which is sinuate-truncate ; punctate-striate, the punctures on the striæ small and feeble ; interstices impunctate, but appearing somewhat silky from excessively fine transverse strigations, which are only visible under a powerful lens ; the striæ are eight in number, besides the short scutellar stria and the marginal stria ; the latter is irregularly interspersed with deep, large punctures ; there are two large punctures in the interstice between the second and third striæ, the one about a third from the base, and the other almost at the very apex. A large testaceous patch occurs at the base of each elytron, stretching obliquely from the shoulder towards the suture, not quite reaching the first stria ; and there is a third testaceous patch near the apex, common to both elytra, and reaching to the fourth stria. The upper side of the last abdominal segment has a number of distinct punctures on it. Under side same colour as the upper, centre rather paler. Legs slight, moderate in length ; the tarsi slender, fourth joint simple (not bilobed) ; claws not pectinate.

NYCTEIS, Casteln.

Under this genus I include all those insects which have the characters of *Coptodera*, excepting the middle tooth of the mentum. Castelnau and Chaudoir have added other characters besides this to the diagnoses of their respective genera, *Nycteis* and *Belonognatha*, which would exclude from them the species I am going to describe ; but as these characters do not appear to me to be of essential value, I consider I do rightly in retrenching them, and thus opening the genus for the reception of species which agree with them in all important points. For instance, the only particulars in which the species which follows (*N. Championi*) differs from Castelnau's diagnosis of *Nycteis* is—1. that in his genus the last joint of the palpi is said to be "obtuse at the end," while mine is "subacuminate," a difference which may perhaps principally lie in the mode of expression ; and 2. that in his the external and sutural angles at the apex of the elytra are more or less spined, while in *Championi* they are not spined, although toothed at the external angle.

The distinctions, too, between this genus and *Belonognatha*, Chaud., do not seem sufficient to warrant their being kept separate. They are, the greater projection of the mandibles and greater convexity of the body in the latter, as well as the external angles of the apex of the elytra being rounded instead of toothed ; but one of the species which follow (*N. intermedius*)

will be found to borrow characters from both, as well as to possess others intermediate between them. It has the elongate labrum canaliculated at the apex of *Belonognatha*, and also has the mandibles longer and sharper than in *Nycteis*, although not quite so prominent as in the other species of *Belonognatha*, while its form is less tumid, and possesses the other characters of *Nycteis*, except that the apex of the elytra is rounded at its emargination instead of being toothed. This combination of characters renders it, I think, impossible to keep the two genera separate, and I have thought it better to unite them, only using the subordinate characters for sectional subdivision. There is one subordinate trivial character, which I have adopted, which separates the species (after abstraction of the above characters) into two groups, nearly equivalent to *Nycteis* and *Belonognatha*, viz. that one group has the elytra (as seen under a powerful lens) finely aciculated, somewhat in the same way as in the *Calathi*, while the other has the elytra polished and shining, without this aciculation, and apparently generally appearing metallic when looked at from in front, and dark-coloured when looked at from behind. I therefore, for these reasons, class the whole of the following species under the generic name of *Nycteis*. If we were to treat characters of similar value in the same way throughout the group, it would be much simplified. We should then throw *Agonocheila*, *Stenoglossa* and *Coptodera* together, characterized as *Coptodera* with a middle tooth to the mentum, as I have thrown *Nycteis* and *Belonognatha* together as *Coptodera* without a middle tooth,—the former inhabiting the New, the latter the Old World. Indeed, I am strongly inclined to believe that the mistake I have already referred to as having been committed in the genus *Lebia*, of confounding the central base of the ligula with the middle tooth of the mentum, has been repeated here; and that if these parts were more carefully examined, it would be found that the species having a true tooth to the mentum are confined to America, while those without the tooth are restricted to the Old World. I do not think that the structure of these parts has been sufficiently minutely attended to by those authors who have described species of *Coptodera* as inhabiting the East Indies and Africa. There are six species described from each of these countries, and if these are analysed, there seems very insufficient evidence for holding that they are furnished with a tooth to the mentum. Of the six Eastern species, one is described by Dejean, four by Schmidt-Goebel, and one by Hope. As to Dejean's species (*C. gilvipes*), we may put it out of view, because he takes no notice of the mentum, and he himself says, "Je ne suis pas bien certain que cette espèce

appartienne à ce genre." Of Schmidt-Goebel's species I have only had the opportunity of examining one (*C. flexuosa*), and I find that it most certainly has no tooth to the mentum; and if this mistake has happened to one of his species, it is none the less likely to have been repeated in the others. I also possess Hope's *C. bicincta*, and there the same mistake or oversight has occurred. The six African species are described, one by Dejean, four by Boheman, and one by Chaudoir. As Dejean habitually disregards the form of the mentum, his placing his species (*G. crucifera*) in the genus *Coptodera* goes for nothing, either one way or the other. Neither does Prof. Boheman say anything about the mentum; and he may either have overlooked it altogether, or fallen into the same error as Schmidt-Goebel and Hope. I have not seen any of his species, but the system of coloration and general description shows a great resemblance to my Old Calabar species, *Nycteis Championi* and *Belonognatha rugiceps*. There only remains the *Coptodera figurata* of Chaudoir, and although it is not likely that he has overlooked the mentum (fully alive as he was to its importance), still it is not impossible that he may have fallen into the error regarding it of which I have been speaking. In my specimens of *Nycteis* from Old Calabar, the central base of the ligula between the roots of the palpi forms a sort of triangular raised space, which on a cursory view might easily be mistaken for a tooth in the middle of the mentum, although more careful examination under a sufficiently high power shows that it may be separated from it, and, in point of fact, does not belong to it at all; so that it is not difficult to see how authors even of such standing and acknowledged accuracy as those referred to, should have fallen into this misconception.

Taking, then, the species without a tooth to the mentum as constituting the genus *Nycteis*, my arrangement of the species belonging to it would be as follows:—

NYCTEIS.

Essential characters the same as in *Coptodera*, but without the middle tooth to the mentum.

Subgenus 1. (*Nycteis* proper.)

Elytra finely transversely aciculated, and body not very convex.

Under this head fall *Coptodera flexuosa*, Schmidt-Goebel, and probably all the other Eastern *Coptoderæ* described by him; *Coptodera bicincta*, Hope; probably all the Caffrarian species described by Boheman; Chaudoir's *C. figurata*, and possibly

Klug's *Beleopterus signatus*, besides my species which follow (*N. Championi* and *N. intermedia*).

Subgenus 2. *Belonognatha*.

Elytra polished and shining, without aciculation; body convex, and mandibles usually prominent and acute.

This subgenus contains the species which are described below (*B. rugiceps*, *obesa*, and *quadrinotata*); besides, doubtless, Chaudoir's species, *B. pustulata*, and, possibly, Klug's *Beleopterus cyanipennis*.

The species received from Old Calabar are as follows, viz. :—

1st Subgenus. (*Nycteis* proper.)

1. *N. Championi*, mihi.

Parum depressa, nitida, fusca vel picea; ore, antennis, thoracis lateribus, elytrorum marginibus, macula basali et fascia irregulari apicali atque pedibus, testaceis; capite fere lœvi, mandibulis non valde prominentibus; thorace late marginato; elytris striato-punctatis, interstitiis convexis et impunctatis, apice oblique truncato et exciso, angulo exteriore apicali acuto; unguiculis pectinatis.

Long. 4 lin., lat. $1\frac{3}{4}$ lin.

Slightly depressed, shining, brown, with the mouth and antennæ, the margins of the thorax and elytra, a patch towards the base and a jagged irregular band towards the apex of the latter, and also the legs, testaceous. Head as broad in front as behind, nearly smooth, with some faint wrinkles upon it, and two considerable depressions on each side, the smallest one on the inside of the eye, and the other larger before it; clypeus transverse, depressed in front; labrum rather broad, and not tapering, rounded at the anterior angles, slightly emarginate and with a shallow longitudinal groove in the middle in front; mandibles slightly rounded exteriorly, not much projecting; antennæ darker towards the apex, slightly flattened and thickened from the end of the fourth joint to the apex; eyes large and prominent. Thorax broad, short, transverse, and somewhat cordiform, with very broad, shallow, semitransparent, reflexed margins, marked in the bottom with faint transverse depressions or foveæ; disk slightly convex, with a longitudinal dorsal line reaching from the front to the base, and a semicircular impression in front; faintly marked with transverse wrinkles; posterior angles somewhat obtuse. Scutellum impunctate. Elytra broader than thorax, slightly expanded posteriorly, punctate-striate, interstices convex and impunctate; a fovea on the second stria near the apex,

another about a third of the length of the elytra from the apex, and another on the third stria, about the same distance from the base; the exterior interstice with a series of round flat-bottomed foveæ; margin inflexed, both the inflexed portion and the raised edge of the margin testaceous; an oblique irregular testaceous patch near the base of each elytron, on the fifth, fourth, third, second, and part of the first interstices, parallel to the side of the scutellum, though at some distance from it; the mark on the third interstice reaches farthest back, that on the fourth farthest forward; an irregular, jagged, testaceous band near the apex also runs across the whole elytra, but indistinct at the suture and on the exterior interstice; the space on the first two interstices reaching nearest to the apex, the two next farthest from it, and the three last again approaching it. The apex is obliquely truncate and excised, the exterior angle sharp, the sutural angle prominent, but scarcely toothed; the last segment of the abdomen punctate on the upper surface; under side of body smooth, shining, impunctate. Legs slender; tarsi simple; claws pectinate.

I have named this species in memory of my lamented friend Lieut.-Colonel Champion, who fell at Inkermann, a naturalist whose loss will be long felt.

2. *N. intermedia*, mihi.

Valde affinis *N. Championi*, sed parum minor, labro magis elongato et ad apicem canaliculato; mandibulis acutioribus; thorace minus transverso et postice angustiore; elytris apice emarginatis sed non dentatis, angulis posterioribus rotundatis, cum maculis anticis grandioribus et maculis posticis minus continuis. Long. 3 lin., lat. $1\frac{1}{3}$ lin.

Has very much the appearance of *N. Championi*, but, on comparison, is readily distinguished by the characters mentioned in the above diagnosis. The insect is smaller, and the coloration a little darker. The labrum is longer, and narrowed towards the point, where it is canaliculated. The mandibles are more slender, more acute, less rounded on the exterior, and narrower at the base. The head is narrower, and is marked by a number of minute longitudinal wrinkles. The thorax is not so transverse and is narrower behind, and the reflexed margin is not quite so broad. The elytra are rounded at the posterior angles instead of being toothed, and the testaceous markings on them are slightly different; the anterior marking is confined to the same striæ, but is comparatively rather larger from the colour running further on some of them; it runs up on the second and

third striæ nearly as far as on the fourth, only sloping very slightly towards the suture, while in *N. Championi* the fourth goes a good deal beyond the third. The posterior markings are the same as in *N. Championi*, but are narrower, and consequently appear almost interrupted where they advance at the third stria and retreat at the fifth. They both have the elytra very finely transversely aciculated, but the aciculations are finer on *intermedia* than *Championi*, the power of lens which shows them in the latter scarcely showing them in the former. In other respects they correspond.

There is yet another species which I have no doubt belongs to this section, and which I would name *quadrimaculata*; but, as yet, I have only received a broken specimen, wanting both head and thorax, and am therefore unable to describe it. It has two large yellow patches on each elytron, the basal nearly round, and the apical transversely oblong, both with very slight traces of jagged edges.

2nd Subgenus. *Belonognatha*, De Chaud.

As mentioned under the last genus, I have slightly relaxed Chaudoir's characters to give admission to the following species. He describes the labrum as "very long, canaliculated at its extremity, strongly rounded and emarginate in the middle." I retrench the latter half of these characters. In my species the labrum is "very long and canaliculated at its extremity," but it is not "strongly rounded and emarginate in the middle." The only other character in which mine differs is, that while in his the anterior tibiae are furnished with a single terminal spine, the intermediate and the posterior with the two usual spines, and the third and fourth joints of the anterior tarsi subcordiform, in mine the external spine of the anterior tibiae is small, but still not wanting, and the joints of the anterior tarsi are not subcordiform. In other respects the characters agree.

1. *B. rugiceps*, mihi.

Parum convexa, nitida, picea; capite creberrime rugoso; thorace late marginato, marginibus reflexis et testaceis; elytris piceo-virescentibus, striato-punctatis, interstitiis convexis, apice oblique-truncato, fortiter sinuato, marginibus testaceis, singulis macula basali irregulari, et fascia interrupta apicali testaceis ornatis; antennis, ore, pedibusque testaceis.

Long. 4 lin., lat. $1\frac{3}{4}$ lin.

In coloration and general appearance very similar to *Nycteis Championi*; slightly convex, piceous; the elytra pitchy black,

slightly virescent, each with an irregular testaceous basal patch and interrupted apical fascia. The antennæ, the parts of the mouth, the margins of the thorax and elytra, and the legs pale ferruginous. Head dark brown or piceous, about the same breadth before as behind the eyes, upper surface exceedingly densely and pretty deeply corrugated all over, so much so as to appear almost opaque; clypeus transverse, narrowest in front, wrinkled, separated from the front by a marked straight line; labrum about the same length as the clypeus, narrowest in front, truncate, with a longitudinal groove in the middle in front, and a puncture on the margin near the apex; mandibles sharp and projecting, but not so much so as in the next species; terminal joint of palpi subcylindric and subacuminate. Antennæ about the length of head and thorax, the end of the fourth, the fifth and remaining joints flattened. Eyes very large. Thorax considerably broader than head, cordiform, gently convex in the middle, and with very broad and deeply reflexed margins, which have here and there a few large punctures scattered in the bottom of the hollow; the disk very faintly wrinkled across, and with a dorsal longitudinal stria; fuscous, but paler than head, in some lights faintly virescent; margins semitransparent and broadly testaceous; posterior angles nearly right-angled; base truncate. Scutellum testaceous-fuscous, impunctate. Elytra shining, broader than thorax, but not twice as broad, somewhat convex; base nearly straight; sides very slightly expanded; pitchy black when looked at from in front backwards, virescent when looked at from behind forwards, deeply punctate-striate; eight striæ, besides scutellar and marginal striæ; the interstices convex and apparently impunctate; but with a very powerful lens, a few punctures of the faintest description may be traced, disposed in a row along each interstice; a fovea on the inner side of the second interstice near the apex, another about one-third from it, and another on the third stria about the same distance from the base; a series of round, flat-bottomed foveæ on the marginal interstice; apex obliquely truncate and excised, the exterior apical angle flattened and rounded; the seventh stria sweeps round at the apex, enclosing those nearer the suture; margin inflexed; inflexed portion and raised edge of margin testaceous; a transverse testaceous patch about one-fourth from the base is disposed as a series of longitudinal stripes occupying five interstices as follows:—the longest stripe between the third and fourth striæ, the second longest between the second and third, the shortest between the fourth and fifth, and the next shortest (two of nearly equal length) between the fifth and seventh; a transverse, interrupted, testa-

ceous fascia runs irregularly across near the apex thus :—a short stripe near the apex on the space between the first and second striæ ; one, a little longer, extends farther towards the apex on the next space ; another, about the same length, occupies the next space, extending towards the base from the anterior part of the last ; the next lies alongside of it, but is not quite so long ; three short ones, each successively becoming smaller, start from the posterior corner of the last, and stretch across to the margin. Upper side of last segment of abdomen smooth and sparingly punctate. Under side shining, impunctate, piceous, paler in the middle ; breast, mouth and legs testaceous ; claws pectinate.

2. *B. obesa*, mihi.

Convexa, nitida, supra fusco-viridis ; thorace late marginato ; elytris punctato-striatis, interstitiis elevatis et convexis, quatuor maculis irregularibus testaceis.

Long. 6 lin., lat. $2\frac{3}{4}$ lin.

Convex, shining, above green, or brown with green reflections ; elytra, when looked at from in front, brown (except at the very base), when from behind, green ; each with two testaceous marks of irregular shape on the disk, one about a third of the length of the elytra from the base, the other about the same distance from the apex ; below brown, with legs ferruginous. Head above green, rather depressed ; eyes prominent, space next the eyes irregularly rugose, inclination of rugosity longitudinal ; vertex rather elongate, smooth ; clypeus quadrangular, narrower in front, brown ; labrum brown, long, narrower in front, margins very slightly reflexed, emarginate in front, and with a slight groove in the middle for a short space, and an indentation on each margin near the front. Mandibles brown, long, fine, sharp-pointed, and projecting almost immediately straight from the eyes, so that the head has a very long narrow triangular muzzle ; other parts of the mouth pale ferruginous ; palpi filiform ; ligula very prominent ; paraglossæ attached to it, and embracing it, but not quite meeting in front ; mentum without a middle tooth. Antennæ a little longer than head and thorax, brown, three first joints paler, first joint most robust, second joint shortest, remainder nearly of equal length and thickness, but, if anything, each becoming a very little longer and thicker than the preceding. Thorax cordiform, bronzy-green, with the edges semitranslucent and semitestaceous ; margins broadly reflexed, most so at the posterior angles, which are obtuse ; base truncate, straight in the middle, sloping obtusely to the posterior angles, a broad margin intervening between the base and disk ;

anterior angles projecting and rounded; dorsal channel and curved line in front distinct; disk convex, impunctate, with transverse wrinkles across it. Scutellum black, impunctate, with two depressions at its base. Elytra very convex, nearly twice as broad as the thorax, gradually expanding behind till they reach about a third from the apex, when they round in, and become sinuate and obliquely truncate; they are deeply punctate-striate, the punctures on the striæ small and close to each other; the striæ (with the exception of the two next the suture) do not reach the base, a narrow smooth space intervening; the interstices between the striæ are ridged, convex, shining, and appear impunctate when viewed by the naked eye or a weak lens; when viewed with a more powerful lens, a row of very minute punctures is seen on the top of each interstice; towards the margin these punctures become more frequent and irregular; one or two foveæ occur on some of the striæ, but they are not constant; the most constant seem to be one on the third stria very near the base, and two on the second stria, one quite at the apex, the other near it; a series of large circular foveæ occurs on the exterior interstice. The anterior testaceous blotch runs in a narrow line across the second, third, fourth and fifth interstices (not reckoning the space between the first stria and the suture as an interstice), and on the third interstice becomes nearly twice as broad, extending itself both up and down; the posterior testaceous mark is arranged transversely, somewhat checker-wise, as follows:—a small spot on the first interstice not far from the apex; another on the second interstice, a little larger, joining the posterior external angle of the first; another rather larger transverse spot on the third and fourth interstices commences at the anterior external angle of the second; and another transverse spot, of the same size as the last, on the fifth and sixth interstices, commences at the posterior external angle of the fourth. The terminal segment of the abdomen projects prominently; it is truncate; the centre alone is of solid texture, black, sparingly punctate, with a slight ridge in the middle. Underside dark brown, polished and impunctate, except the metasternum, which has its exterior margins slightly punctate. Legs ferruginous; anterior tibiæ emarginate; all the tibiæ with both internal and external spines at the apex. Claws pectinate.

3. *B. quadrinotata*, mihi. Pl. XVI. fig. 3.

Præcedenti valde affinis, sed minor; thorace minus marginato; elytrorum maculis minoribus.

Long. $4\frac{1}{4}$ lin., lat. $2\frac{1}{4}$ lin.

Exceedingly like *B. obesa*, but smaller. The same description

will answer for it, with the following differences:—The thorax is comparatively smaller, and not so broadly margined, and the anterior rounded angles are rather less prominent. The testaceous spots on the elytra are much smaller, being limited to small points; the basal spot scarcely extends beyond the third interstice, although, on close examination, it is seen to encroach a little on each of the adjoining interstices, and the apical spot is almost confined to the third and fourth interstices.

This may be merely a variety of the preceding. If there had been nothing to distinguish them but the markings on the elytra, I should not have thought of separating them; but the less-margined thorax induces me to keep them separate, at least until a larger series of specimens shall enable us to come to a different conclusion.

THYREOPTERUS, Dej.

1. *T. flavosignatus*, Dej. 5. 446.

Nigro-piceus, subpubescens; thorace quadrato; elytris tenuem striatis, punctatis, singulis macula basali sinuata, conjunctis macula apicali sinuata communi, femoribusque flavis.

Long. 4-4 $\frac{1}{2}$ lin., lat. 2-2 $\frac{1}{2}$ lin.

CATASCOPUS, Kirby.

1. *C. Senegalensis*, Dej. 5. 453.

Supra capite thoraceque viridibus; elytris viridi-cyaneis, profunde striato-punctatis, intersticiis subæqualibus, margine laterali viridi; pectore, abdomine pedibusque piceis.

Long. 5 lin., lat. 1 $\frac{5}{4}$ lin.

2. *C. Beauvoisii*, Casteln. Et. Ent. 60.

Statura et colore *C. Senegalensi* simillimus, parum grandior et lator; elytris viridibus vix viridi-cyaneis, margine laterali viridi-cupreo; subtus niger, leviter virescens; pedibus piceis, femoribus ferrugineis.

Long. 7 lin., lat. 2 $\frac{1}{2}$ lin.

3. *C. rufipes*, Gory, Ann. Soc. Ent. Fr. ii. 204.

Supra viridi-cyaneus, elytrorum margine concolore, capite et thorace leviter rugosis; subtus piceus, pedibus rufis.

Long. 4 $\frac{1}{4}$ lin., lat. 1 $\frac{1}{2}$ lin.

Var. *rugifrons*, mihi.

Supra cupreo-viridis, capite crebre aciculato, thorace sat fortiter transversim aciculato.

Long. $4\frac{1}{4}$ lin., lat. $1\frac{1}{2}$ lin.

The following are the points in which this variety differs from the typical specimens :—

The head, instead of being almost smooth in the middle and towards the back, and only faintly furrowed on the sides, is covered closely all over with distinct fine wrinkles, mostly longitudinal, with a few punctures scattered among them behind. The thorax also is much more coarsely transversely wrinkled, and the colour is yellowish-green instead of bluish-green.

I have not thought these distinctions sufficient to constitute a different species, but they are too well marked to allow me to pass it over unnoticed.

4. *C. compressus*, mihi.

Depressus, supra viridi-æneus, nitidus; capite antice, antennis pedibusque brunneis; thorace angulato; elytris viridibus leviter æneo-marginatis, fortiter striatis; subtus brunneus vel nigro-piceus.

Long. $2\frac{5}{8}$ –3 lin., lat. $1\frac{1}{4}$ lin.

Smaller, flatter, and more depressed than any species of *Catascopus* yet described; having the compressed form of an insect living under bark; shining, above brassy-green; the elytra greenest, the thorax less so, the head only with a faint reflexion of green on the back part; the rest of the body blackish-brown or piceous. Head slightly rugose on the sides, with an oblique depression inclined towards the vertex; behind smooth; labrum much produced, opake; clypeus shining, very slightly emarginate in front, with a fovea on each side; antennæ brown, first joint paler. Thorax somewhat convex, smooth and impunctate, with a deep dorsal line, the sides and base slightly reflexed and margined; the base obtusely truncate; the posterior angles excised, so as to be nearly right-angled; after leaving the excision which forms the right angle at the base, the sides widen out gradually till about a third from the front, where they form a pretty sharp prominent angle*, and then gradually become narrower till they reach the anterior angles, which are rounded; the slight projection or angle alluded to, causes the sides of the thorax, instead of appearing rounded, to appear as if angular; there is a fovea at the base on each side of the dorsal line, about midway between it and the angle; the reflexed

* This is a character peculiar to all the true *Catascopi* which I have seen.

margin is broader at the base than at the sides; there is a slight tendency to transverse wrinkling across the disk, more particularly behind. Scutellum black and opake, and scarcely reaching beyond the interspace between the thorax and elytra. Elytra rather broader than the thorax, with the base nearly straight, but sloping slightly from the shoulders (which are rather prominent) inwards to the scutellum; their sides are nearly parallel; they are shining, greenish, with a tinge of brassy on the margins, becoming slightly coppery at the very apex, deeply striate, and with faint indications of punctures at the bottom of the striæ; the interstices are impunctate, but under a powerful lens show fine transverse strigations, which give them a somewhat silky appearance; there are eight striæ, besides the scutellar stria and the outer marginal one, which, with that next it, is the deepest; a number of deep punctures or foveæ occur on the marginal stria, or on the interstice between it and the next one; a deep puncture also occurs on the inner side of the third stria, not quite half-way from the base, and another on the outer side of the second stria, almost at the apex; the apex is sinuate-truncate. Upper side of the last abdominal segment silky-opake, with a number of distinct punctures. Underside and legs shining brownish-black, or piceous, impunctate; legs moderate in length and slender; tarsi slender, fourth joint simple; claws not pectinate.

Ozœnidæ.

GONIOTROPIS, Gray.

The species which follows certainly belongs to this genus, although it differs in one or two points from the characters which have been given as generic by Gray. That author gives the mandibles as pluridentate on the inner side, and the anterior thighs as dentate on the under side, neither of which is the case in my *G. Wyliei*; but, as in other respects it agrees with the diagnosis of *Goniotropis**, I do not propose to make a new genus for it on account of them, but merely withdraw the above specialties from the characters of the genus, and thus widen it to receive the following species.

1. *G. Wyliei*, mihi.

Castanea, nitida, lœvis; capite antice et postice levissime punctato, vertice elevato, impunctato; mandibulis elongatis,

* The reader will find the generic as well as the specific characters noticed in the following description, so that he can satisfy himself that I have not overlooked any of importance.

robustis, non dentatis; labro integro; thorace marginato, angulis posticis fere rectis sine emarginatione; elytris, capite et thorace paulo longioribus, parallelis, cum carina marginali interrupta et fortius plicata versus apicem; femoribus non dentatis, tibiis anterioribus arcuatis, intus fortiter emarginatis. Long. 5 lin., lat. $1\frac{1}{2}$ lin.

Colour uniform chestnut; shining, smooth. Head faintly, acicularly, irregularly punctate in front, and still more sparingly behind, with the vertex raised and impunctate; clypeus solid and smooth, outline in front very slightly concave; labrum transverse, and almost as broad in front as behind, entire*, a row of punctures, from which hairs proceed, extending along the front; mentum with a tooth in the middle; ligula short, narrow, truncate; paraglossæ broad, truncate, adhering to the ligula throughout their length; labial palpi short and robust, last joint somewhat securiform; maxillary palpi longer, last joint subcylindric, depressed, and truncate; mandibles robust, elongate, and rounded in front, a few scattered hairs along their exterior, without teeth on the interior margin; antennæ about as long as the head and thorax, flattened, gradually increasing in size to the end, the last joint more than twice as long as the preceding. Thorax as long as broad, cordiform, surrounded with a border along the sides, flat anteriorly, but broader and reflexed behind, ending in a fovea near the basal angles, which are nearly right-angled; no emargination in front of them; dorsal line not reaching quite to the front; a curved line in front, and a transverse line a little before the base, which is truncate and almost straight. Elytra elongate and nearly parallel, with a reflexed margin or raised keel running along the exterior sides to near the extremity, where it terminates, and then another keel commences a little within it, with a more prominent fold, which continues for a very short space, and is then replaced by an ordinary raised margin, which disappears near the apex; an inner raised callosity or rounded ridge commences near the above fold, and continues parallel to it and the raised margin nearly to the apex, where it joins it, and both cease; under a powerful lens, the elytra are seen to be sparingly

* The labrum can hardly be called emarginate, although perhaps the anterior angles may be said to be very slightly more advanced than the centre of the anterior margin; still the line of margin is very nearly straight. A similar slight inequality would perhaps explain how the figure published by Gray of his *G. Brasiliensis* shows an emarginate labrum, while he makes no mention of its emargination in the text, and would confirm the view taken by Lacordaire, that the genus *Ictinus* of Castelnau (which has the labrum entire) is identical with the *Goniotropis* of Gray, notwithstanding this apparent discordance in their characters.

and faintly punctate; one or two rows of deeper, distant punctures (eight or nine in number) occur on the disk, and a series of foveæ runs along the marginal depressed space next the raised margin. Under side and legs a little paler than upper side, shining, bearing throughout a few scattered punctures, and somewhat pubescent, more particularly the tibæ and tarsi; thighs without teeth, but the anterior pair have a hollow space on the under side; anterior tibæ strongly arched and very deeply emarginate on the inside, the margin of the excised space very closely fringed with pubescence, and a slightly incurved tooth, with a few hairs projecting behind the emargination; intermediate and posterior legs simple; coxæ of the former adjoining each other; anterior pair more separated, and posterior pair widest apart; trochanters of the latter large and broad; tarsi of all the legs short and robust; claws simple.

I have named the above species of this rare and interesting genus after Mr. Wylie, to whom I am indebted for this as well as many other valuable species discovered and sent home by him.

Morionidæ.

MORIO, Latr.

1. *M. Guineensis*, Imhoff, Verh. d. nat. Gesells. in Basel, vi. 166.

M. Senegalensis, Dej. Cat.

Niger, nitidus, depresso; thorace lato, subcordato, angulis anticis prominulæ, posticis rectis, medio et utrinque intra basin sat profunde canaliculato; elytris thoracis fere latitudinis, quam latis non duplo longioribus, parallelis, striatis, intersticiis subconvexis lævibus; pedibus ferrugineo-fuscis.

Long. $8\frac{1}{2}$ –6 lin., lat. 3–2 lin.

This species varies considerably in size, so much so as almost to lead one to suppose that there are at least two species confounded under the same name, particularly as the larger individuals seem to the eye broader in proportion than the smaller ones. Careful examination and measurement, however, show that this is a mere ocular deception, the relative proportions being the same. It approaches very nearly to *anthracinus*, Bohem., and *parallelus*, Klug. The relative proportions of this species are as follow:—Thorax broader than long. Length of elytra about $1\frac{1}{2}$ or $1\frac{3}{4}$ times their breadth, and rather more than twice the length of the thorax. In my specimens from Senegal the elytra are rather more elongate, being nearly twice as long as they are broad; but as I can find no other difference, I do not consider this a new species.

PLATYNODES, Westw.

1. *P. Westermanni*, Westw. Trans. Ent. Soc. 1845, p. 278. vol. iv.
pl. 21. fig. A. Pl. XVII. fig. 7.

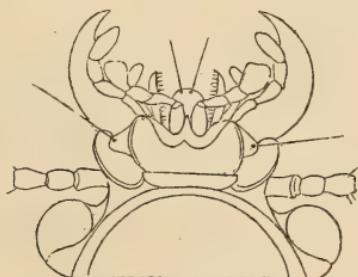
Niger, subnitidus ; capite magis nitido, antennarum articulis apicalibus brunneis, superficie corporis lœvi ; singulo elytrorum striis 7 simplicibus et gracillimis instructo, spatio inter striam 6 et 7 ad latera in carinam elevato, spatioque intra marginem lateralem punctis parvis rotundatis impresso.

Long. $13\frac{1}{2}$ lin., lat. $4\frac{1}{2}$ lin.

The insect I have from Old Calabar seems to be the same species that has been already described and figured by Mr. Westwood (*loc. cit.*). I have only received a single specimen, and I find one or two trifling discrepancies between it and the figure given by Mr. Westwood, as well as a typical specimen of *P. Westermanni* in the magnificent collection of the Count Mnizseck in Paris. These are the following :—The antennæ in my specimen are not quite so much thickened ; the anterior tarsi are less dilated ; the scutellum is smaller, and the posterior angles of the thorax are less salient. These may be mere sexual distinctions or accidental variations.

Mr. Westwood, in his generic description of this insect, says that the abdomen has only four segments. I would express this differently. It may only have four separable segments, but the segments are in reality five, the first two segments being soldered together, so that their line of separation is indistinct in the middle ; but it is quite distinct and well marked at the sides. This appears to be the normal state of matters in the *Morionidæ* and *Scaritidæ*. There is also a side-piece before the first segment, which may be viewed as part of another segment.

STEREOSTOMA, mihi (*στερεὸς* and *στόμα*).



Corpus elongatum, parallelum et parum convexum. Caput parvum, parum convexum, quadratum, pone oculos sine

tumore et sine collo retractato. Labrum breve, transversum. Mandibulæ robustæ, subitus concavæ et excavatæ, supra rotundatæ, apice acutæ, intus sine dente. Maxillæ parvæ. Palpi breves et robusti: articulus ultimus palporum maxillarium ovato-cylindricus et truncatus; palporum labialium grandis, crassus et late securiformis. Mentum breve, transversum, profunde excavatum et fortiter emarginatum, cum dente medio simplici et malis acutis, lateribus rotundatis, extus valde alveato. Ligula curta et angusta, truncata. Paraglossæ nullæ. Antennæ breves, moniliformes, articulis apicalibus velutinis, compressis et dilatatis versus apicem, singulis spatio sat lato lævi et nitido et supra et subtus relichto. Prothorax subquadratus, parum subcordatus, capite multo latior, postice quam antice parum angustior et longitudinaliter bifoveolatus; basi medio leviter transverse productus. Prosternum sat latum et retro paulo projiciens. Scutellum parvum. Elytra elongata, parallela, striata, sat convexa, apice abrupte declivia et leviter emarginata, haud truncata. Pedes mediocres. Tibiæ anticæ dilatatæ, subtus excavatæ, intus emarginatæ. Tarsi breves, transversi, fere moniliformes, antici breviores; in foemina, et supra et subtus nitidi et politi, sine setis vel squamis, ciliis ad marginem anteriorem singulorum adstrictis exceptis; in mari, antici setis longis instructi, ceteris ut in foemina*; unguiculi simplices. Abdomen segmentis quinque, quorum primum et secundum conglutinata sunt.

1. *St. Whitei*, mihi. Pl. XVII. fig. 6.

Nigrum, politum, nitidum; capite foveis quatuor et lineis tribus fronte impressis, quadrangulariter positis; thorace elytris angustiore, postice longitudinaliter bifoveolato, angulis posticis rectis, elytris striatis, striis leviter punctatis, interstitiis impunctatis planis.

Long. 6 lin., lat. $2\frac{1}{2}$ lin.

Black, polished and shining. Head smooth and polished, and rather convex; mandibles hollowed out below, and having some resemblance to the beak of a hawk; antennæ short, robust, compressed and dilated towards the apex; first three joints smooth, with one or two large punctures on the first and second, the rest dull pubescent, with a broad, flat, polished line running up

* I make this statement only from the examination of a male specimen of *St. Whitei* and a female of *St. solidum*, these being all which have come into my hands. But I have no doubt it is correct, as I find a similar difference in structure in the other *Morionidæ*.

the middle of the compressed sides, both above and below, nearly to the end of the last joint; some of the joints with one or two punctures on the polished space; clypeus marked off from the head by a straight impunctate line, which ends at each side in a deep puncture or fovea, from which a shorter and fainter line runs obliquely outwards and forwards to the exterior base of the mandibles; from each of these two foveæ an impunctate line runs straight backwards and very slightly outwards, ending in another deep elongate puncture or fovea on each side of the front between the eyes, so that the marking on the front consists of three lines forming three sides of a square, each corner being marked by a deep puncture, the fourth or posterior side of the square being open or without any line; besides these punctures, there are two others on the inner edge of each eye, one at the middle, which partly interrupts a longitudinal groove running along the side of the eye and head, and the other behind, where the groove terminates at the posterior inner angle of the eye; there is no tumour behind the eye, but its posterior margin is slightly encroached on by the black chitinous substance of the head, but without the contour of the eye being altered. Thorax subquadrate, slightly cordiform, impunctate, shining, much wider than the head, narrower than the elytra, emarginate, becoming narrower behind; anterior angles projecting and rounded; sides gently rounded and margined, the margins extending round the anterior angles, and then gradually becoming wider and disappearing before the middle; the base not margined; a channel runs along the sides inside the lateral margin, in which six or eight large impressions are placed widely apart; the base is transversely produced in the middle, as in *Lebia*; at the sides it is straight, and the posterior angles are nearly right-angled; dorsal stria faint and interrupted until towards the base, where it becomes deeply impressed; a very deep fovea on each side of it, nearer the sides than it, with a longitudinal impunctate groove in the bottom of the fovea; prosternum with a faint longitudinal depression, impunctate. Scutellum small and impunctate. Elytra elongate, parallel, margined, punctate-striate, the striae deepest towards the apex and margin, the punctures in the striae small, and not very close to each other; the striae are seven in number, and there is no abbreviated stria near the scutellum; interstices flat and impunctate, except the marginal interstice, which is impressed with a row of large, round, circular depressions, each with a point in the centre; the elytra are somewhat flat on the disk, and they suddenly and rapidly descend at the sides and the apex, which is not truncate, but sinuate; the first and second striae join together

at the apex, and the third and fifth or sixth enclose those between them. Under side polished, shining, impunctate, except a row of four or five large punctures on each segment of the abdomen; there are five segments, besides a side-piece in front of them, but the first and second are soldered together, and the separation between them is not to be seen except at the sides, so that on a cursory view there only appear to be four segments; tibiæ with spinous hairs on the exterior, strongest on the anterior pair; posterior and middle tarsi longer than anterior.

I have dedicated this species to my friend Mr. Adam White, of the British Museum, to whose extensive information and kind assistance I have been on many occasions much indebted.

2. *St. solidum*, mihi.

Præcedenti valde affinis sed major, latior et convexior; thorace elytris vix angustiore, angulis posticis productis; elytris striato-punctatis, intersticiis impunctatis convexis.

Long. $7\frac{1}{2}$ lin., lat. 3 lin.

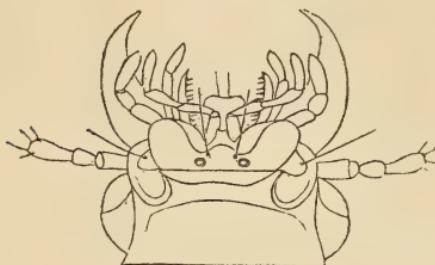
Very closely allied to the preceding species, but larger, broader, and more convex; the posterior margin of the eye is more encroached on by the chitinous substance of the head than in the last; the polished space in the middle of the flat sides of the antennæ is rather broader, and is entirely smooth and without punctures. Thorax more convex, broader, and less narrowed behind than in the preceding species, scarcely narrower than the elytra, bisinuate in front, and with the posterior angles projecting backwards; there is a greater number of impressions in the channel along the margin than in the last species; prosternum with several deep punctures arranged somewhat in a longitudinal double row along its projecting part. Elytra punctate-striate; interstices impunctate and convex, the punctures and impressions on the sides deeper and more distinct than in the last species; the stria next to the suture also is nearer it, which makes the rest of the interstices look wider; the part of the elytra beside the suture is more depressed than the rest. In other respects the two species agree.

BUDERES, mihi ($\beta\omega\delta$ and $\delta\epsilon\rho\eta$).

Caput parvum, quadratum, parum convexum, pone oculos sine tumore, sed parte postica oculorum tecta. Labrum transversum, antice quam postice latius, angulis anticis projicien-
tibus margineque antico emarginato et ciliato. Mandibulæ

robustæ, extus rotundatæ supra carinatæ, apice acutæ haud denticulatæ. Maxillæ acutæ. Palpi breves et modice robusti; palporum externorum articulus ultimus longus et cylindricus, articulus penultimus triangularis basi pedunculatus; articulus ultimus palporum labialium elongato-ovatus. Mentum latum, leviter excavatum et profunde emarginatum, cum

Fig. 2.



dente medio bifido et malis rotundatis. Ligula curta, truncata, leviter emarginata, antice quam postice latior, carinata. Paraglossæ nullæ. Antennæ breves moniliformes, articulis apicalibus pubescentibus compressis et dilatatis, spatio sat lato lævi et nitido singulis relichto et supra et subtus. Prothorax subquadratus, anguste marginatus, capite multo latior, antice quam postice parum angustior, lineis duabus posticis longitudinaliter impressus, angulis anticis parum acutis, posticis fere rectis. Prosternum sat prominens et paulo projiciens. Scutellum mediocre. Elytra prothoracis fere latitudine, breves, sat convexa et sat fortiter marginata, striata, apice emarginata haud truncata. Pedes mediocres. Tibiæ anticæ dilatatae, intus emarginatae, subtus excavatae. Tarsi breves transversi et moniliformes, antici breviores; in foemina et supra et subtus nitidi et politi, sine setis vel squamis, ciliis ad marginem anteriorem singulorum adstrictis exceptis; in mari antici squamis setisque instructi, ceteris ut in foemina. Unguiculi simplices. Corpus haud elongatum, parum convexum. Abdomen segmentis quinque, quorum primum et secundum conglutinata sunt.

This genus is allied to the preceding, but it differs in its shorter, more compact, and convex shape, somewhat different form of the thorax, and in its mentum having a bifid tooth in the middle instead of a single tooth; in the last joint of the labial palpi being slender elongate-ovate instead of large, swollen and securiform, and in the under side of the anterior tarsi in the

male being furnished with closely applied squamulae instead of long bristles.

1. *B. Oberti*, mihi.

Nigrum, politum, nitidum; capite foveis duabus sinuatis fronte longitudinaliter impresso, singulis lineis duabus antice conniventibus impressis; antennis brunneis; thorace impunctato marginato, lineis duabus posticis angustis impresso; elytris impunctatis septem striis impunctatis impressis, postice profundioribus, interstitiis convexis; pedibus brunneis.

Long. $5\frac{1}{4}$ lin., lat. $2\frac{1}{4}$ lin.

Black, polished, shining. Head smooth and polished, convex behind; labrum with a row of large punctures (from which spring hairs) in front; mandibles with a bisinuated keel, broadest in the middle, running along the upper side; antennæ ferruginous-brown, short, robust, compressed and dilated towards the apex; the first three and greater part of the fourth joints polished, the rest dull pubescent, with a flat, polished line running up the middle of the compressed sides, both above and below, nearly to the end of the last joint; a narrow marginal ridge runs along each side of the head until it reaches behind the eye; the two frontal impressions are sinuate, each composed of two deep lines which meet in front and extend in a sinuate manner backwards, diverging gradually from each other; they are joined in front by a straight transverse line: all these lines are impunctate. The thorax is subquadrate, and has somewhat the form (in miniature) of that of some species of *Pasimachus* (e. g. *P. sublaevis*, Beauv.); it is smooth, shining, and impunctate; the dorsal median line is faint, and reaches neither to the front nor base; the two foveated lines at the base are placed nearly midway between the dorsal line and the margin, but rather nearer the middle; they are long, deep, well defined and narrow, and at their base turn off towards the sides at a right angle, forming a narrow ridge on the exterior portion of the base, which is wanting in the centre, and which continues along the lateral margins round to and past the anterior angles, and a considerable distance along the anterior margin, but fades away before reaching its middle; a deep channel thus runs along parallel and close to the margins of the thorax; the prosternum is rather broad, and slightly produced and expanded behind; near the termination of the expansion there is a sort of double depression, which leaves a narrow raised margin. Scutellum small, im-

Fig. 3.



punctate, scarcely reaching to the part of the elytra where the striae commence. Elytra smooth, shining, and impunctate, with seven deep impunctate striae besides the marginal stria; the striae become deeper towards the apex; there is no abbreviated sutural stria; the first two striae run alongside up to the apex; the third and fourth join together a short distance from the apex, and their united line goes on for a short distance; the fifth and sixth do the same; the seventh runs the whole length, becoming wider towards the apex, where one or two circular punctures or foveæ occur; the marginal stria has a number of these impressed on it; it runs up to the apex, where it widens much, and is divided by a raised line, which proceeds from the emargination near the apex; the marginal ridge of the elytra is rather broad and prominent; a faint stria runs along the under margin of the reflexed edge of the elytra; the interstices between the striae are convex, but more so on the sides and towards the apex than at the middle and base. The under side is smooth, polished, and impunctate, except two minute punctures, one on each side of the middle of each segment of the abdomen; the segments also show depressions along the sides. The legs are ferruginous-brown.

I have named this interesting species in honour of my esteemed correspondent, M. Obert, of the corps of Cadets, Paulow, St. Petersburg.

OCHYROPUS, Schiödte.

Prof. Lacordaire disallows this genus, not considering it sufficiently distinct from *Scarites*; the only differential characters given being, that the second joint of the labial palpi is enlarged on the inner side and prolonged at its anterior internal angle, that the mandibles are toothed in their whole length, and that the last joint of the tarsi is of the length of the preceding joints united. The last of these characters is incorrect; the last joint, although long, not being so long as represented, and scarcely longer than that in other species of *Scarites*. The second character (the toothed mandible) is unimportant, even although it were not found in other species of *Scarites* (which it is). But the enlargement of the second joint of the labial palpi is of more value: it is long, broad and flat, expanded on the inner side of its anterior angle, and strongly ciliated, so that it seems to be almost a second maxilla, and no doubt serves the purpose of such. This seems a sufficiently important character to justify us in retaining the genus as distinct, the rather that the *facies* of the insect is different from that of *Scarites*. Its thorax is

narrowed in front more than in any other species, and its form is deeper.

1. *O. gigas*, Schiödte in Kröyer Naturhist. Tidsk. ser. 2. ii.
p. 350. tab. 4.

Grandis, niger, nitidus; capite foveis duabus elongatis postice convergentibus, fronte impresso, postice lateribus sparsim punctato, vertice impunctato; mandibulis fortiter dentatis, supra bicarinatis, capite longioribus; thorace antice angustato, marginato, linea punctorum ad marginem et pluribus ad angulos anteriores impresso, margine exciso ante medium; elytris parallelis, substriatis, interstitio secundo, quarto et sexto sparsim et irregulariter, leviter sed distinete punctatis; crinibus ferrugineis sat longis ex punctis, tam capite quam thorace et elytris orientibus; subtus minus nitidus; tarsis robustis, articulo ultimo elongato.

Long. 24 lin., lat. 7 lin.

SCARITES, Fabr.

1st Division of Dej. *Intermediate tibiæ with two prominent external spines.*

1. *S. Hercules*, mihi. Pl. XVI. fig. 4.

Niger, subdepressus; mandibulis magnis, fere usque ad apicem dentatis, thorace longioribus; mento valde concavo, cum duabus foveis profundis et rotundis in medio ad basin; thorace transverso, duplo lato quam longiore; elytris elongatis, thorace triplo longioribus, subquadratis, subparallelis, marginatis, pone medium paulo dilatatis, carina basali, dente humerali, et carina longitudinali ex humeris orienti paratis, subtiliter punctato-striatis, ad basin et lateribus papillosum; tibiis anticis tridentatis, postice haud denticulatis.

Long. 23-20 lin., lat. $6\frac{1}{2}-5\frac{1}{2}$ lin.

A fine large species. Black and shining. The head and mandibles broad and massive, but varying in size; mandibles longer than the thorax, bicarinated on the exterior side, declive at the tip, dentated interiorly almost to the tip, the teeth consisting of one or two larger ones at the base, and three or four smaller ones before them; antennæ black or piceous, the basal joints rounded and shining, the rest flattened and pubescent, with a broad polished line running along them both above and below; head smooth, with two deep longitudinal foveæ turning away in front nearly at right angles towards the antennæ; wrinkles more or less distinct radiate from these depres-

sions ; an irregular depression lies in the margin just behind the labrum, which, as in the other species of this genus, is small and transverse, rounded on the sides, and toothed in the centre ; a very large and prominent projection behind the eye encroaches on the posterior half of it ; a few scattered, very faint punctures and wrinkles may be seen about the vertex ; the back part of the head below is irregularly and pretty closely punctate ; mentum very concave ; middle part with a deep rounded hole (about the size of a pin's head) on each side of the middle ridge, which forms the apex of the middle tooth ; a double line (connected here and there) runs up the middle of the back part of the head, terminating in front in two punctures ; one puncture, or two combined into one, lies immediately behind the posterior angles of the mentum. Thorax transverse, twice as broad as long (taking the measurement of the breadth at the widest, and of the length at the middle), sloping gently from the anterior angles to the fold or tooth on the margin, and rapidly from thence to the base ; dorsal line distinct to the anterior marginal line, which is faint ; space along that line marked with short, faint, longitudinal lines or folds ; projection of prosternum smooth and rounded, sometimes slightly depressed in the middle, with traces of three faint lines behind, the two marginal ones diverging outwards. Scutellum situated on the peduncle, basal portion somewhat rugose ; prescutellar space coarsely rugose, except in front and on the sides, where it is smooth. Elytra elongate, a little more than three times the length of the thorax, subparallel and subquadrate, margined, the margin dilated a little behind the middle, faintly punctate-striate, the base and margins covered with small papillæ ; three impressions on the third stria, the first about a third from the base, the next rather more than a third from the apex, and the last between this and the apex, but furthest from the latter ; a ridge runs along the base to the shoulder, and terminates in a prominent tooth ; it is not greatly curved, and just within the tooth a ridge commences, running nearly parallel to the sides of the elytra, but sloping a little inwards ; it has a scarcely perceptible sinuation near the base, and disappears before it reaches the apex ; traces of a row of punctures inside this ridge are visible near the base, and the stria next to it is the deepest. Under side shining ; one distinct puncture on the posterior coxæ, also two punctures on each segment of the abdomen, one on each side of the middle, besides shallow depressions along the sides, and transverse wrinkles more or less distinct ; the last segment has also another puncture on the margin, a little exterior to the other two ; anterior tibiæ tridentate, without denticulations behind ; under side of the palmate portion with a number of papillæ or small

spines; middle tibiæ with a strong spine projecting externally near the apex, a smaller one behind it, and a row of minute papillæ or spines further back.

2. *S. Ajax*, mihi. Pl. XVI. fig. 5.

Præcedenti affinis, sed minor; niger, subdepressus; mandibulis bidentatis, thorace brevioribus; thorace haud duplo latiore quam longiore; elytris elongatis, thorace fere triplo longioribus, subquadratis, subparallelis, marginatis, pone medium paulo dilatatis, subtiliter punctato-striatis, carina basali, dente humerali, et carina longitudinali ex humeris orienti paratis, ad basin et lateribus papillosum; tibiis anticis tridentatis.

Long. 18 lin., lat. $5\frac{1}{2}$ lin.

Allied to the preceding, but smaller, and at once distinguishable by its shorter mandibles, which are not so long as the thorax, and have only two teeth instead of six or seven; by the thorax not being twice as broad as long, and the exterior margins not sloping so much inwards towards the tooth on the sides of the thorax, so that the thorax looks rather more quadrate; the ridge running down the elytra from the shoulder has less appearance of sinuation, though it is so slight in either, that it scarcely deserves to be spoken of; the impressions on the third stria seem also different, the two posterior impressions being placed further back; but, as they vary in different examples, and even on different elytra of the same individual, no great value can be placed on this character. In other respects the description of *S. Hercules* will apply to this. It is still more nearly allied to *S. Feisthamelii*, Laferté. It is, however, larger and more massive, the striæ on the elytra seem more defined and less punctate, and the thorax is comparatively narrower, particularly in front, the length of both being nearly the same (3 lin.), while the greatest breadth in front of *S. Feisthamelii* is $4\frac{3}{4}$ lin., and in *Ajax* $5\frac{1}{4}$ lin.

It is possible that a larger series of specimens may show these two to be the same species; but, until we obtain this, I have preferred to keep them distinct.

3. *S. Patroclus*, mihi.

Niger, nitidus, elongatus, subcylindricus; mandibulis thorace brevioribus, oblique corrugatis; mento corrugato, carina media parato; capite antice longitudinaliter corrugato, fronte bifoveolato; thorace parum convexo, sesqui latiore quam longiore, lateribus antice fere parallelis, ad angulos posticos leviter papilloso; elytris parallelis, parum convexis, anguste

marginatis, punctato-striatis, carina basali, vix dente humerali paratis, et sine carina longitudinali, ad basin et lateribus papillosis; subtus prosterno truncato; tibiis anticis tridentatis, postice quadridenticulatis, subtus transverse corrugatis.

Long. 15 lin., lat. $4\frac{1}{2}$ lin.

Black, shining, elongate, subcylindric; head corrugated longitudinally in front, and with two longitudinal frontal foveæ, turning off transversely towards the exterior anterior angle; a ridge or projection in front of the eye, and a very slight swelling behind the eye encroaching on part of it; mandibles not longer than the thorax; left mandible with one large subquadrate tooth, right mandible with two; the upper side with two ridges or keels on the exterior side, and the whole furrowed with strong, oblique corrugations curving inwards; labrum longitudinally corrugated, with three projections or teeth, and a large, deep puncture in the middle of the central projection; mentum corrugated and papillose, a central keel with a longitudinal fovea on each side of it running up the middle of the median tooth; antennæ as in the other species, but rather more slender in proportion, fuscous. Thorax subquadrate; sides subparallel, only sloping very slightly in, till they reach the marginal tooth (which is scarcely one-fourth from the base), when they turn in directly to the base; in the posterior angles there are a number of faint papillæ; there is a margin all round the thorax continued in front, where it is widest; the dorsal line, which is distinct, reaches this margin, but does not enter on it. Scutellum situated on peduncle; smooth; prescutellar space rugose in the middle, smooth all round. Elytra nearly parallel, subconvex, punctate-striate, interstices impunctate; a narrow margin surrounds the elytra, next to which, both at the base and all round, there is a space covered by papillæ; a row of impressions runs up the middle of these papillæ; the margin at the base takes the shape of a keel, ending in a small tooth at the shoulder; there is no longitudinal keel starting from this and running up the elytra; there is no appearance of larger impressions upon the striæ; there is some appearance of the papillæ spreading themselves in a very faint form near the apex. The under side is not so smooth as the upper; the segments of the abdomen are very finely granulated; the prosternum and mesosternum have a number of minute, scattered papillæ on their sides, and the back part of the under side of the head is slightly rugose or granular; two distinct punctures occur, one on each side of the middle of the abdominal segments, the last segment having another puncture on the exterior margin; the first and second

segments are soldered together, and appear as one ; the anterior tibiæ are tridentate, with four smaller distinct teeth behind them ; the inferior surface of the palmated space is transversely corrugated ; the middle tibiæ have two larger teeth projecting near the apex, and a number of minute denticulations behind them.

2nd Division. *Intermediate tibiæ with only one prominent projecting spine.*

4. *S. rotundicollis*, mihi.

Niger, nitidus ; antennis pedibusque ferrugineo-brunneis ; capite fronte bifoveolato et antice bipunctato ; thorace angulis posticis rotundatis, et intra eos leviter papilloso ; elytris curtis, obovatis, striatis, punctis tribus impressis ; tibiis anticis tridentatis, postice unidenticulatis.

Long. $7\frac{1}{2}$ lin., lat. $2\frac{1}{2}$ lin.

Black, with the antennæ and legs ferruginous brown. Mandibles with two longitudinal carinæ, and several smaller carinæ within them sloping obliquely inwards ; labrum tridentate ; front of head with a tooth projecting on each side of labrum, and one or two longitudinal grooves beside these teeth ; two longitudinal foveæ on each side of the front at equal distances between the eyes, deepest in front ; and on each side, a little on the exterior and in front of their termination, is a round, flat-bottomed puncture with a depression in its centre, and a faint line leading from this towards the anterior corner of the head ; the eyes have a very slight, scarcely observable tumour behind and below them ; mentum longitudinally rugose, two elongate foveæ in the middle, the space between which forms a ridge, which terminates in the point of the middle tooth. Thorax somewhat quadrate, with the posterior angles rounded behind from the tooth on the margin, and alongside and within them a few small papillæ gathered together ; margined both on the sides (which are slightly rounded) and behind, but not in front ; dorsal line faint, not reaching to the front. Scutellum situated on the peduncle, transverse, smooth, with a ridge across ; prescutellar space rugose. Elytra short and obovate, except at the base, which is truncate ; deeply and broadly striate, particularly on the sides and apex, where the striæ are almost as broad as the interstices ; the striæ impunctate ; interstices impunctate and convex, particularly so where the striæ are deepest ; three impressions on the third interstice (counting the sutural space as an interstice), the first more than half-way from the base, the second about a fourth from the apex, and the third on the point where the third and fifth

interstices combine together shortly before reaching the apex ; a few very minute papillæ at the base degenerate into a slightly rugose surface along the margin, and a row of punctures occurs on the marginal space and at the base ; the margin distinct and equal all round, not being expanded ; the humeral tooth distinct. Under side polished and shining ; division of head behind mentum marked ; punctures on segments of abdomen same as in preceding species ; anterior tibiæ furnished with two long teeth, one short one behind, and a small one behind it,—so that they may be said either to be bidentate and bidenticulate behind, or tridentate and unidenticulate behind, it being doubtful whether the third tooth should go with the large teeth or the small one ; intermediate tibiæ with one prominent projecting tooth, and a number of smaller and decreasing ones ; posterior tibiæ without teeth.

5. *S. Clivinoides*, mihi.

Niger, nitidus ; antennis pedibusque nigro-piceis ; capite fronte bifovealato, foveis longitudinaliter rugosis, postice una et altera parte rugoso et punctato, vertice lævi ; thorace lateribus fere parallelis ; elytris parallelis, longitudine dimidii corporis, striato-punctatis, ad basin forte et lateribus leviter papilloso-rugosis, striis apice paulo lævioribus ; tibiis anticis tridentatis, postice unidenticulatis.

Long. $6\frac{1}{2}$ — $5\frac{3}{4}$ lin., lat. $1\frac{3}{4}$ lin.

Small ; black, shining. Head quadridentate in front, the two outer teeth longest ; two deep longitudinal foveæ on each side of front, exactly behind margins of labrum ; the foveæ are longitudinally rugose ; from each a sinuate furrow runs backwards and outwards, and two or three others on each side start from it or near it about the middle, faintly at first, but becoming wider and deeper as they go backwards, and stopping about the same distance from the front as the back part of the eye does ; where they stop there are some smaller lines or furrows, and two or three irregularly-shaped punctures, which extend faintly across the head, except at the middle, which is smooth, as is also the space behind ; the eyes are rather flat, and are somewhat encroached on behind by the integument, but there is no swelling behind them ; antennæ pitchy black ; mandibles moderate, shorter than head, bicarinate, with oblique wrinkles or subcarinæ within the interior ridges ; labrum with a slight rounded projection on each side and in the middle, and a puncture in each ; mentum obliquely rugose. Thorax rather broader than long, impunctate ; sides nearly parallel, narrowly margined ; angles rounded ; tooth or fold on the sides very small ; dorsal line

distinct, reaching from base to anterior marginal line, and very faintly beyond it; the anterior marginal line is deep, and shows marks of punctuation, particularly on the anterior side; the space in front of this line is comparatively narrow. Pre-scutellar space rugose in the middle, and scutellum more finely so. Elytra of the length of the half of the body, with sides parallel, punctate-striate, papilloso-rugose on the inflexed portion of the base, and very faintly so with a series of punctures on the space within the margin, which is strongly raised; the margin takes a sudden descent from the humeral tooth, for about a fourth part of the length of the elytra, where it forms an angle and follows the line of the elytra; the striæ are fainter at the apex, the terminal portions of some of them being obliterated; the third and fourth striæ join together about one-fourth of the length of the elytra from the apex. Under side impunctate, except the posterior part of the head, which is faintly punctate, and the usual row of punctures on each side of the middle of the abdominal segments. Legs pitchy-black; anterior tibiæ tridentate, with a small tooth or tubercle behind them; thighs of middle legs with a row of punctures along the under side.

CLIVINA, Lat.

1. *C. grandis*, Dej. ii. 478.

Nigra; thorace quadrato; elytris elongatis, parallelis, punctato-striatis, punctis quatuor impressis, margine tenui, macula postica, antennis pedibusque rufis.

Long. $5\frac{1}{4}$ lin., lat. $1\frac{1}{2}$ lin.

Panagæidæ.

CRASPEDOPHORUS, Hope.

Isotarsus, Laferté.

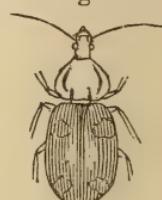
1. *Cr. conicus*, mihi.

Niger, pilosus; thorace antice angustiore, pos-tice latiore et ad basin truncato, punctato, lateribus rotundatis et postice elevatis; elytris latis, punctato-striatis, maculis duabus flaviis, altera antica transversa interstitia sex tegente, altera postica transversa interstitia quinque tegente.

Long. $8-9\frac{1}{2}$ lin., lat. 4 lin.

Black, pilose. Head narrow, polished, margined, with an elongate deeply-punctured fovea on each side from the eyes for-

Fig. 4.



ward; a few scattered punctures on the raised vertex between these foveæ, behind which there is a transverse series of fainter punctures; a deep oblique puncture or line at the anterior angles; labrum emarginate and pitchy-black; palpi pitchy-black, with the terminal joints pilose; antennæ as long as half the body, black and pilose, slightly thicker in the middle than at either extremity; neck smooth and impunctate. Thorax narrowed in front, broadest behind the middle, truncate at the base, anterior angles meeting the neck, anterior margin between them nearly straight; very coarsely punctate, sparsely pilose; narrowly margined, and with a slightly raised space within the margin, narrow in front, wider behind, on which the punctuation is fainter; an elongate fovea on each side at the base, and a minute tooth at the posterior angles, which are rounded and obtuse; no dorsal line. Scutellum minute. Elytra rather convex, broad, black, with two fulvous spots on each, one near the base, the other near the apex, both transverse; the coloured spaces not raised, nor of a different texture from the rest of the elytra; deeply punctate-striate, the punctures on the striæ transverse; interstices convex and punctured, pilose, the hairs black on the black parts of the elytra, fulvous on the fulvous spots; the anterior of these spots commences on the 3rd interstice, and is continued on the 4th, 5th, 6th, 7th and 8th interstices, the extent and form of the fulvous marking varying in different individuals; the posterior marking is confined to the 4th, 5th, 6th, 7th and 8th interstices; the 9th interstice and marginal space are not encroached on by the fulvous spots; the marginal space is marked by a series of cross-wrinkles rather than punctures; the apex is slightly emarginate, but not truncate. Underside black, pilose, hairs piceous; prosternum sparsely and deeply punctate; inferior margin of thorax impunctate; sides of mesothorax and metathorax coarsely punctate; segments of abdomen finely and acicularly punctured, with some large, coarse punctures or foveæ on their sides; inflexed margin of elytra finely punctate. Legs black and pilose.

This species should be placed near the *Panagæus festivus* of Dejean. At first I supposed it to be the *Panagæus tropicus* of Hope, and I have distributed it among my correspondents under that name, but I am afraid I have been hasty in doing so. I have not seen Hope's species in nature; but Mr. Westwood's recent appointment to the curatorship of the Entomological Collection at Oxford (an appointment on which all entomologists must felicitate themselves) having rendered Mr. Hope's collection again useful to science, I have availed myself of his kindness to ascertain (so far as can be done without actual in-

specion of the insect itself) whether any of my species of *Craspedophorus* correspond with Hope's. Mr. Westwood's report confirms my doubt as to this species (although he observes that it is of the same general form), and, coupled with Hope's description, leads me to consider the two species distinct. His description is as follows:—"Long. lin. 8, lat. lin. $3\frac{1}{2}$. Niger; antennis atris, thorace *semicirculari* *haud excavato*, subdepresso et crebrissime punctulato. Elytris sulcato-punctatis quatuor maculis subquadratis flavis pedibusque nigris. *Hab.* In Sierra Leone. This species has the two anterior spots covering six interstitial spaces, while the posterior cover only five*." This description, so far as it goes, corresponds with my species, except that in mine the thorax cannot be called semicircular, or not excavated; it should rather be called conical, and it certainly is excavated, especially posteriorly. Mr. Westwood has furnished me with a sketch of the thorax of *tropicus*, which shows that it is more semicircular and shorter than in *conicus*. Hope's species also is somewhat smaller. The number of interstices over which the yellow spots extend (a particular which Mr. Hope gives as a good specific character throughout the genus) corresponds with that in his *tropicus*, excepting that the anterior marking sometimes covers the whole of the third interstice, at other times scarcely impinges on it at all.

2. *Cr. strangulatus*, mihi.

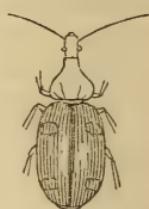
Valde affinis præcedenti, sed thorace antice fortiter constricto; elytris punctato-striatis, maculis duabus flavis, singulis interstitia quinque tegentibus.

Long. $7\frac{1}{2}$ – $8\frac{1}{2}$ lin., lat. $3\frac{3}{4}$ lin.

Very closely allied to the preceding species, and the same description will answer for both, with the following exceptions.

This species is rather smaller. Its head is somewhat narrower. Its thorax is quite differently shaped, being narrow, constricted in front, and rather rapidly expanded behind; the posterior angles are obtuse, and not so much rounded as in *conicus*. The elytra are shorter, not quite so convex, and the interstices also are less convex; the fulvous markings are narrower, particularly the posterior spot, and the colour of the anterior spots does not encroach on the third interstice, and is thus confined to five instead of six interstices. The punctures on the interstices are somewhat coarser and less numerous than

Fig. 5.



* Annals of Nat. Hist. vol. x. (1842–3) p. 94.

those on the rest of the elytra, and seem to be rather more transverse.

In other respects the characters of the two species correspond. Their extreme similarity, except in the form of the thorax, suggests the idea that they may possibly be sexes of the same species. As the tarsi in this genus furnish no indication of the sex, I endeavoured to satisfy myself on this point by detaching the abdomen and dissecting out the sexual organs, which I found, although not very decipherable, to be at least exactly the same in both species. They would appear therefore not to be sexes of the same species. Neither do I think they can be varieties, the difference of form in the thorax being too great to allow of such a supposition. I should also mention that I have received specimens of *conicus* in several consignments, but *strangulatus* came only upon one occasion, and then in small numbers.

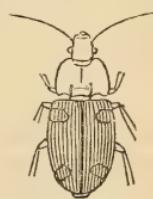
3. *Cr. arcuato-collis*, mihi.

Niger, pilosus, depressiusculus; capite latiore; thorace depresso, lateribus rotundatis, ad basin una et altera parte arcuato, profunde punctato, lateribus posticis lævioribus; elytris punctato-striatis, maculis duabus flavis, singulis interstitia quinque tegentibus, altera antica recte transversa, altera postica oblique transversa.

Long. $7\frac{1}{2}$ lin., lat. $3\frac{1}{2}$ lin.

Black, pilose. Head broad, polished, margined on each side in front of the eyes, very coarsely punctured over the whole surface of the head, except upon the clypeus, which is large, semicircular, and straight in front; it is less closely punctate on the neck; there are two not very deep depressions more closely punctate on each side in front; labrum pitchy; palpi ferruginous, terminal joints pilose; antennæ not so long as half the body, filiform. Thorax somewhat quadrate, depressed, coarsely punctured, narrowest in front, sides rounded and margined, anterior angles rounded and projecting, posterior angles rounded-in, with a minute tooth caused by a small excision at the angle; basal margin arched on each side towards the angles, middle space nearly straight, projecting backwards in consequence of the arch on each side; dorsal line well marked; an inner depression a short distance within the lateral margin, following somewhat its line, nearest to it in front, diverging from it behind, more deeply punctate than the rest of the surface, behind joining a basal depression about half-way between the middle and the exterior angle, the basal depression not separated

Fig. 6.



from the margin by any raised space, very coarsely punctured. Scutellum small and smooth. Elytra rather depressed, not much broader than thorax, punctate-striate; sides somewhat parallel and margined, black, with two transverse fulvous spots, the one near the base extending transversely across the 4th, 5th, 6th, 7th and 8th interstitial spaces, the other near the apex extending obliquely and transversely backwards over the same interstices; the contour of spots pretty regular, but the colour on the 5th and 7th interstices most extended, particularly in the anterior spots; the coloured spaces not raised, nor of a different texture from the rest of the elytra; the interstices finely punctate, somewhat flattened on the disk, but very convex towards the sides; the marginal space marked with cross-punctures. Under-side black, pilose, hairs piceous; prosternum and breast deeply punctured, inferior margin of thorax impunctate; segments of abdomen finely acicularly punctured, with one or two deep foveæ or large punctures on the sides of the basal segments; inflexed margin of elytra almost impunctate. Legs black and pilose.

This species is allied to the *Cr. selenoderus* of Laferté, but may be at once known by its much greater size, it being fully a third larger.

4. *Cr. Lafertei*, mihi.

Niger; thorace obcordato, ad basin truncato, angulis anticis rotundatis et projicientibus; elytris curtis, maculis duabus rufis, altera antica fere ad humerum posita et ad marginem attingente, interstitia quinque tegente; altera postica transversa, interstitia quatuor tegente.

Long. $7\frac{1}{2}$ –8 lin., lat. $3\frac{3}{4}$ lin.

Black. Head rather broad, closely covered with small punctures, which become confluent here and there, particularly in two foveæ on each side of the head; space in front (clypeus) impunctate, smooth and shining, with one large puncture on each side; antennæ piceous, darkest at base; palpi ferruginous. Thorax obcordate, very uniformly covered with punctures smaller than those in any of the preceding species, becoming faint and disappearing towards the margin near the posterior angles; the margins are expanded and very slightly reflexed, and at the anterior portion they have a narrow edging or border; anterior angles projecting and rounded-in to the neck, truncate at the base; posterior angles slightly projecting backwards, and with a slight exterior excision at the point; middle portion of base also very slightly projecting backwards; the dorsal line is distinct, except behind, and there is an elongate straight depression at

Fig. 7.



the base on each side. Scutellum triangular, with the sides slightly sinuate, smooth and impunctate. Elytra sparingly pilose, short, convex, and looking somewhat as if curtailed, punctate-striate, the striæ deep, particularly towards the apex, and with the interstices convex and punctate; marginal space with a distinct row of transverse punctures; two clear red or ferruginous spots on each elytron, the anterior reaching to the margin, and extending over the 5th, 6th, 7th, 8th and 9th interstitial spaces; this spot runs obliquely from the shoulder in the direction of the suture, is rounded opposite to it, and then returns in a slightly rounded line to the margin; the posterior spot is short and nearly transverse, and is confined to four interstitial spaces, the 5th, 6th, 7th and 8th, and is most prolonged on the 7th; the spots are of the same texture as the rest of the elytra, and are not raised above their surface; apex emarginate. Under-side with the prosternum and breast deeply punctured, the prosternum more sparsely than the breast; inferior margin of thorax shining, and with faint traces of punctures; inflexed margin of elytra finely punctate; sides of segments of abdomen coarsely punctate, less so towards the apex, middle portion finely aciculated. Legs pitchy-black, with tibiæ piceous and tarsi dark ferruginous.

I have named this species in honour of the Marquis de Laferté Senectère, who has published an able revision of the group on which we are at present occupied, and has been kind enough to give me the benefit of his information as to my new species.

5. *Cr. grossus*, Hope. Pl. XVII. fig. 8.

Panagæus grossus, Hope, Ann. Nat. Hist. x. (1842) 94.

Panagæus grandis, Imh. Verhandl. d. Nat. Gesellsch. in Basel, v. p. 166.

“ Niger; antennis atris; thorace fere hexagono, angulis anticis rotundatis, posticis abrupte truncatis, disco subconvexo punctato, lateribus parum depresso et marginatis; elytris sulcato-punctatis, quatuor maculis rubro-miniatis insignitis, corpore pedibusque nigris*.”

Long. 11 lin., lat. $4\frac{1}{2}$ lin.

I believe this species to be, as above stated, the *grossus* of Hope. His description, as is usual with him, is more concise than we could have wished; and I shall therefore add a somewhat more detailed description, although the admirable figure by M. Migneaux, in Pl. XVII., renders any additional description scarcely necessary.

* Hope in *loc. cit.*

Black. Head impunctate, but finely rugose between the antennæ, with an elongate fovea on each side, in which the rugosities almost take the appearance of punctures; antennæ black and piceous towards the apex; clypeus smooth and elevated in the middle. The thorax may rather be described as truncate-cordate than as hexagonal, but as both the anterior and posterior portions of the lateral margins are somewhat straight, either expression may be used without being inconsistent with the truth; it is faintly and not very closely punctured, sparingly pilose; the margins reflexed; the dorsal line distinct, but reaching neither to the front nor the base; a deep longitudinal fovea is on each side of it at the base; the base is truncate, a broad space in the middle projecting very slightly backwards; the anterior angles are narrow, and project a little, and are rounded; the posterior angles are right-angled, and have the usual excised tooth. Scutellum small and impunctate, with the sides gently curved. Elytra convex and obovate, pilose or pubescent, deeply punctate-striate, the punctures faint; the interstices are convex and finely punctate; the spots are red, with a tinge of vermillion; the anterior occupies four interstitial spaces (the 5th, 6th, 7th and 8th), and also the marginal space, but not the raised margin, which is prominent; the posterior spot occupies the same striæ, but not the marginal space; the spots are of the same texture as the rest of the elytra, and are not raised; the marginal space might be called the last interstitial space, as it is broad and raised like the rest, but in addition to the fine punctuation found in the interstitial spaces, it has a series of larger pits of various sizes, with a raised point in their middle; the hairs are piceous, except on the red spots, where they are red; they are red on the under side of the body, which is sparsely punctured on the prosternum, breast, and sides of the segments of the abdomen (their middle portion being slightly aciculated). The tarsi are piceous.

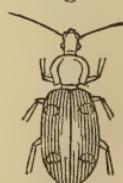
6. *Cr. Erichsoni*, Hope.

Fig. 8.

Niger, rugose punctatus; thorace fere circulari, ad basin truncato et in medio retro projiciente, lateribus reflexis, rugose punctato; elytris punctato-striatis, maculis duabus parvis fulvis elevatis, singulis interstitia quatuor tegentibus.

Long. 8 lin., lat. $3\frac{1}{4}$ lin.

Black. Head moderate rugosely punctate, with a longitudinal fovea on each side in front, and a smooth rounded elevation between them, margined on each side in front of the eyes; palpi



nearly smooth. Thorax small, very deeply and coarsely punctate, on a hasty inspection appearing nearly circular, the anterior angles being rounded-in to the anterior margin, which is almost straight; the sides behind the middle sloping more rapidly to the posterior angles, which are obtuse and have a slight excision; base truncate at the sides, with the middle space (which is also truncate) abruptly projecting backwards, as in *Lebia*; margins broadly reflexed, more narrowly in front, the depression ending in a deep fovea on each side behind; the reflexed margins are punctate in the same way as the rest of the thorax, but the basal foveæ are nearly free from punctures; dorsal line almost imperceptible. Scutellum elongate triangular, impunctate. Elytra elongate, somewhat parallel, sparingly pilose, deeply punctate-striate; interstices convex, finely and sparsely punctate, the punctures both on the striae and on the interstices are transverse, becoming towards the sides and on the marginal space almost transversely strigose; two yellow spots on each elytron, the anterior transverse, and about a fourth of the length of the elytra from the base, the posterior obliquely transverse and about a fourth from the apex: the spots are of a different texture from the rest of the surface, somewhat raised, glossy and lustrous, and nearly impunctate, and are placed on the 5th, 6th, 7th and 8th interstitial spaces, projecting most forward on the 6th, most backward on the 7th; apex slightly emarginate. Under-side with the prosternum and sides of breast coarsely punctate; inferior margins of thorax impunctate; sides of the segments of abdomen coarsely punctate, middle smooth, with aciculations; inflexed margin of elytra somewhat rugose. Coxæ punctured. Legs slender.

I learn from Mr. Westwood that this is Hope's *Erichsoni*, although, from his description, I should not have found it out. It is interesting from its approaching the New Holland species, *australis*, Dej., to which it bears considerable resemblance.

7. *Cr. Symei*, mihi.

Niger vel brunneo-niger, pilosus; antennis ferrugineis; capite parum punctato; thorace fere hexagono, pone medium latiore, fortiter punctato, lateribus posterioribus testaceis et translucentibus, foveis elongatis duabus ad basin; elytris crenato-striatis, interstitiis leviter punctatis, maculis duabus testaceis, altera antica interstitia sex et marginem tegente, ad humerum ascende, altera postica interstitia quinque tegente; pedibus testaceis.

Long. $3\frac{1}{4}$ lin., lat. $1\frac{1}{4}$ lin.

Of the form and facies of *Panagæus crux-major*, but smaller.

Black, or fuscous black, pilose; the pubescence or hairs testaceous. Antennæ and palpi ferruginous. Head punctate between the eyes; the clypeus smooth. Thorax somewhat hexagonal, truncate at base, the greatest breadth a little behind the middle, uniformly coarsely punctate, the margins a little expanded and reflexed posteriorly, and where expanded testaceous and semi-transparent; dorsal line faint, and on each side of it an elongate basal fovea; the middle of the base very slightly and abruptly projecting backwards. Scutellum small, smooth. Elytra somewhat elongate and parallel, crenate-striate, the interstices faintly punctate; two testaceous spots on each elytron, the anterior covering the whole interstitial spaces from the 4th to the raised and inflexed margin inclusive, anteriorly gradually ascending from the 4th till it reaches the 7th interstice, on which and the remaining portion of the side of the elytron the colour runs up to the base, where it turns in again upon the 6th and 5th, and posteriorly runs down a short space upon the 7th or 8th and the remaining lateral space; the posterior spot is narrower, and confined to the 4th, 5th, 6th, 7th and 8th interstices, being curved obliquely backwards. Under-side black; prosternum and breast coarsely punctate, and segments of the abdomen finely punctured, with a few coarser punctures on the sides. Legs testaceous.

I have dedicated this species to my friend Mr. John T. Syme, Lecturer on Botany in St. George's Hospital, London, a very able and zealous entomologist.

It is not without doubt that I have placed it in the genus *Craspedophorus* instead of in *Panagæus*. It has much more the appearance of *Panagæus crux-major*, *P. fasciatus*, &c., than of any of the *Craspedophori* with which I am acquainted, but none of the three specimens which I possess have the anterior tarsi dilated. It may be that they are all females, or it may be that the tarsi of the males are not dilated. In the absence of proof that they are dilated, I have kept this and the following species in this genus (of which the non-dilatation in the males is the essential character), notwithstanding that I cannot help thinking they more properly belong to *Panagæus*.

8. *Cr. vicinus*, mihi.

Valde affinis præcedenti, et differt præcipue in macula antica non attingente marginem elytrorum.
Long. $3\frac{3}{4}$ lin., lat. $1\frac{1}{2}$ lin.

Very closely allied to the preceding species—possibly only a variety. It is rather larger, has the foveæ at the base of the thorax rather deeper and broader, and the testaceous or yellow

markings on the elytra differently disposed. The anterior spot does not reach the margin, being confined to the 4th, 5th, 6th, 7th and 8th interstitial spaces, the colour being shortest on the 5th and longest on the three last; the posterior spot is confined to the same interstices, almost disappearing on the last; it is more transverse and not so much curved obliquely backwards and outwards as in *Symei*.

Chlæniidæ.

HOMALOLACHNUS, Laferté, Ann. Soc. Ent. France (série 2), ix. 293.

1. *H. elongatus*, mihi.

Chlænius elongatus, mihi, Annals, 2nd series, xix. pl. 13. fig. 9, June 1857.

Capite nitido, antice subvirescenti, postice leviter punctulato; thorace nigro, angusto, confertissime et profunde punctato, parce piloso, marginibus subcupreis; elytris nigro-viridibus, opacis, punctato-striatis, intersticiis punctatis et geminato-pilosis, maculis duabus flavis, una transversa circa medium posita, altera minore apicali; subtus niger; pedibus piceis, femoribus testaceis, tibiis anterioribus et intermediis in parte testaceis, tarsis anticis valde dilatatis in maribus.

Long. $6\frac{1}{2}$ lin., lat. $2\frac{1}{4}$ lin.

Narrow and elongate; antennæ with the two basal joints ferruginous, except a piceous patch on the upper side of the first joint, the remainder black or fuscous, the fourth and following joints pubescent, flattened, and wider at the middle joints than at either end; palpi piceous. Head smooth, polished, virescent, lightly punctate behind. Thorax narrow, with a tendency to be cylindrical, but margined, narrowed both behind and in front, narrowest behind, widest about the middle; in front very much rounded-in, and anterior angles fitting close to the neck; the sides gently rounded, becoming straighter a little before the posterior angles, which are rounded and obtuse; very deeply and closely punctate; the punctuation becomes confluent towards the sides, and closest behind; sparingly pilose; margin a little raised towards the posterior angles, and having within it a little of a cupreous or æneous lustre; dorsal line distinct, reaching neither to front nor base, deepest in front. Scutellum impunctate. Elytra long and narrow, widest behind the middle, opaque, black or bluish-green, the green colour most seen when looked at from in front; punctate-striate, interstices punctate, and bearing a double row of yellowish hairs; with two yellow spots on each, the anterior broader than long, transverse, occupy-

ing the 4th, 5th, 6th, 7th and 8th interstices, placed about the middle, although from the declivity towards the apex they look as if rather behind the middle; the posterior spot smaller, and lying close to the emargination of the apex (which is slight), where several striæ meet, and only separated from the margin by the marginal space; neither of the spots reach the three interstices next the suture; slightly margined; marginal space very narrow, not differing from the other interstices, except in there not being room for any punctuation at all. Under side black, in certain lights iridescent blue. Prosternum and breast coarsely punctate. Abdomen polished, a few coarse punctures near the base. Legs piceous; thighs testaceous, in certain lights bluish iridescent; anterior and intermediate tibiæ partly testaceous; the first three joints of the anterior tarsi very much dilated in the males, and furnished with long spongy squamæ and very long hairs on each side; 1st joint transversely triangular, 2nd and 3rd rounded quadrate, 4th not dilated.

This species is very close to the *Homalolachnus vertagooides* of Laferté, but differs from his description in the following particulars: viz. In my species the head is punctate behind, and there are traces of punctuation near the eyes, while in *vertagooides* the head is said to be smooth (*lisse*). In it, too, the thorax is said to have its greatest breadth at about two-fifths of its length, and the posterior angles are said to form a right angle very slightly obtuse, whilst in my species the greatest breadth is at the middle, and the posterior angles are rounded and something more than "very slightly obtuse." The spots on the elytra do not cover the same interstices, Laferté saying that in his species the anterior spot is separated from the suture by only two interstitial spaces (including in them the sutural space), while in my species it is separated therefrom by three spaces. The colour of the legs also does not quite correspond; the knees are all black in mine, and the middle of the tibiæ of the two anterior pair testaceous, while in *vertagooides* Laferté gives the whole of the thighs as testaceous, and the whole of the tibiæ as blackish. It may, however, be merely a variety.

CHLÆNIUS, Bon.

(*Division with yellow spots on the elytra.*)

1. *Ch. oculatus*, Fab.

Ch. Myops, Dej. v. p. 622.

Ch. Chevrolatii, mihi, Annals, vol. xix. No. 114. tab. 13. fig. 10.

Capite et thorace viridi-aeneis, nitidis; thorace angustato, crebre et profunde punctato; elytris obscure cyaneo-viridibus antice,

et fere nigris postice, punctato-striatis, interstitiis granulatis et confertissime minute punctatis, macula flava pone medium; subtus niger, pedibus et primis tribus articulis antennarum, palpis atque trophis testaceis.

Long. $5\frac{1}{2}$ lin., lat. 2 lin.

Until corrected by M. de Laferté, I was under the impression that this species was different from the *Ch. oculatus*, Fab., and had attached the name *Ch. Chevrolatii* to it, in honour of my friend M. Chevrolat, in the figure which I published of it in Plate xiii. in the 'Annals' of June, 1857. The reader is requested to make the following alterations in the names at the bottom of that plate: viz. in place of *Chlaenius Chevrolatii* to insert *C. oculatus*, Fab.; and for *Chlaenius diaphanicollis* to substitute *Eccoptomenus eximius*, Dej.

(Division with yellow margins to the elytra, expanded posteriorly.)

2. *Ch. conformis*, Dej. v. 630.

Capite thoraceque viridi-æneis, nitidis; thorace subquadrato, antice angustato, transversim rugoso, sparse sed sat profunde punctato; coleoptris obscure viridi-æneis, pubescentibus, striato-punctatis, interstitiis planis subtilissime granulatis, macula communi postica lunata, antice versus marginem leviter recurvata; thoracis margine tenuissime, antennis pedibusque testaceis.

Long. $6\frac{1}{4}$ - $6\frac{3}{4}$ lin., lat. $2\frac{1}{2}$ - $2\frac{3}{4}$ lin.

(Division without yellow markings or margins.)

3. *C. Feronoides*, mihi.

Affinis *Chlaenio glabratu*s, Dej., parum obesus, supra virescenti-niger, subtus testaceus, nitidus; thorace subquadrato, polito, obsolete sparsim punctato, antice subangustato; elytris striato-punctatis, interstitiis convexis subopacis leviter sparsim punctatis, antennarum basi pedibusque testaceis.

Long. $7\frac{1}{4}$ lin., lat. 3 lin.

Allied to the *Chlaenius glabratu*s, Dej., and having considerable similarity in general appearance to *Pæcilus cupreus*, Linn., or *Anisodactylus vires*ns, Dej.

Somewhat obese in form. Above with head and thorax shining, and elytra dull, black; head virescent, and thorax with a slight tinge of virescence, most observable on the margins; elytra almost without virescence, except a slight tinge at the base. Head smooth and shining, slightly punctate, chiefly behind, with an elongate depression on each side in front,

and a slight impression in the centre of the forehead; clypeus brown with a virescent reflexion, shining; labrum not emarginate or at any rate scarcely so; the antennæ, labrum (which is dull), mandibles, palpi, and other parts of the mouth rufescent; antennæ with the first joint pale, first three joints shining, the rest pubescent. Thorax subquadrate, narrowest in front, narrowly margined on the sides, which are flatly expanded behind, and are rufescent and semitransparent; base broadly emarginate in the middle; posterior angles broadly rounded and slightly obtuse, anterior angles slightly projecting, dorsal line well marked, but scarcely reaching to the front or base, a deep and well-marked longitudinal fovea on each side of the dorsal line, about midway between it and the posterior angles, and a shallower punctate depression on the inner side of the expanded margin; the surface sparingly but distinctly marked with scattered punctures of various sizes, largest and most frequent along the base and near the dorsal line. Scutellum curvilinearly triangular, rufescent, polished, and with a slight triangular depression in the middle. Elytra glabrous, dull, punctate-striate, the punctures in the striæ delicate, some coarser punctures scattered irregularly (or sometimes with a tendency to a linear arrangement) over the interstices; a few larger impressions on the marginal spaces towards the apex; slightly pubescent towards the sides; the margins and the edges of the suture translucent-rufescent. Under side shining, and scarcely punctate, except on the breast, which is coarsely punctured. Legs testaceous.

Readily distinguished from *Chlaenius glabratus*, Dej., by the elytra being black and dull, and showing scarcely any indication of virescence, while in *glabratus* they are green and metallic.

4. *Ch. immunitus*, mihi.

Elongatus, politus, nitidus, supra ianthinus, subtus niger; antennæ, palpis pedibusque testaceis; thorace angustato, sparsissime punctato; elytris elongatis, depressis, fere glabris, punctato-striatis, interstitiis impunctatis.

Long. $7\frac{3}{4}$ lin., lat. 3 lin.

Elongate, polished, shining, above of a rich violet-blue, below black; labrum and mandibles ferruginous; antennæ, palpi and legs testaceous. Head smooth and impunctate, except a few scattered punctures running across between the posterior angles of the eyes, and one or two larger punctures before these, alongside the eyes and front of the head; labrum scarcely emarginate. Thorax narrow, with a few distinct punctures scattered very sparingly here and there over the surface, some of them

disposed in something like a row on each side of the dorsal line, which is distinct, but reaches neither to the front nor base; margined, a few punctures along the margin; a very deep elongate-impunctate fovea placed on each side somewhat obliquely near the posterior angles, which are obtuse, but scarcely rounded. Scutellum large, black, and impunctate. Elytra glabrous, shining, elongate, depressed, deeply punctate-striate, interstices impunctate; besides the punctures in the bottom of the striæ there is a row of from six to ten small punctures along the inner margin of the 3rd and 5th striæ, and also along the interstice next the marginal space, which is granulose, with a row of round, shallow pits with an elevation in the centre; the granulose space becomes widest at the apex, which is very slightly emarginate. Under side polished, prosternum and breast faintly and very sparsely punctured; metasternum more closely punctured; traces of coarse punctuation along the sides of the basal segments of the abdomen. Legs testaceous.

This species, in its general outline, has much the aspect of an *Epomis*, and has also some approach to its generic characters. The palpi are rather more securiform than in most of the *Chlænii*; it has the foveæ on the mentum, which are suggested by Prof. Lacordaire as possibly a good character by which to distinguish *Epomis* from *Chlænius**; but the palpi are not more securiform than those of some other *Chlænii*, and it wants the yellow margin of the elytra.

5. *Ch. Fairmairei*, mihi.

Capite virescenti et thorace viridi, nitidis; thorace subquadrato, sparsim punctato; elytris obovatis, subconvexis, nigris, punctato-striatis, interstitiis impunctatis; subitus niger; pedibus rufescensibus.

Long. $8\frac{1}{4}$ lin., lat. $3\frac{1}{3}$ lin.

Head virescent with feeble violet reflexions, impunctate or nearly so, faintly wrinkled here and there, chiefly transversely; the usual anterior foveæ effaced, or only visible in particular lights; clypeus virescent, narrowest in front, slightly emarginate, with a puncture near each corner before and behind; labrum distinctly emarginate; antennæ piceous, basal joints

* I fear this character must be renounced as of generic value in this group, as I find several species, which cannot otherwise be separated from *Chlænius*, possessing it, while in others it exists in a greater or less degree. I have observed, however, that wherever it is present in a marked degree, the species have the general aspect of *Epomis*, though they may not have the yellow margins on the elytra, as for instance, the present and several species, from Hong Kong and the East.

paler; remaining parts of mouth piceous; palpi slender; mentum with an elongate deep hollow on each side of the median tooth, but scarcely forming a distinct pit. Thorax subquadrate, narrowed both before and behind nearly equally, broadest about the middle, broadly but not deeply emarginate at the base; posterior angles rounded and obtuse; dorsal line distinct, reaching nearly to the front, but not to the base; green with a bluish tinge; sides margined; smooth, shining, and with a few rather large punctures scattered sparingly and irregularly over the surface; a deep basal longitudinal impression on each side of the dorsal line, extending obliquely outwards and backwards, from the anterior end of which a fainter curved impression extends obliquely outwards and forwards. Scutellum impunctate. Elytra obovate, somewhat convex, except on the disk, which is slightly depressed, black, deeply punctate-striate, the interstices narrowest towards the sides and apex, convex and impunctate; apex slightly emarginate; marginal space granulose towards the apex, with variolose foveæ along the space. Under side black; prosternum deeply and coarsely punctate in the centre, its episterna smooth, with one or two coarse punctures; mesosternum and its episterna thickly punctate, and the abdominal segments pretty thickly punctate, most so on the sides. Legs obscurely rufescent.

I have dedicated this species to my friend M. Léon Fairmaire, President of the Entomological Society of France.

6. *Ch. Waddellii*, mihi.

Capite viridi et thorace virescenti, nitidis; thorace obcordato, sparsim punctato; elytris elongatis, depresso-nigris, vix virescentibus ad basin, punctato-striatis, intersticiis convexis impunctatis; subtus piceus; antennis pedibusque rufescentibus. Long. 12-13 lin., lat. 4½-5 lin.

A large species, about the size and with the general form of *Epomis circumscripatus*.

Head metallic green, sparingly punctured behind, and with two small longitudinal foveæ in front, about which are one or two punctures; a few longitudinal wrinkles along the sides; clypeus of the same colour as the head, with four small foveæ, deepest anteriorly, two in front and one on each side; antennæ rufescent, first three joints shining, the rest pubescent; labrum rufescent, darkest in the middle, not emarginate; mandibles piceous; palpi rufescent, basal joints paler. Thorax obcordate, narrowed behind, broadly emarginate at the base; posterior angles rounded and obtuse; dorsal line distinct, reaching to the base, or nearly so, but not in front beyond the semicircular

line, black, slightly virescent on the back, but bright metallic bluish-green on the anterior angles and sides, which are margined; smooth, shining, and with a few rather large punctures scattered sparingly and irregularly over the surface, a little more frequently towards the base; a deep, impunctate, longitudinal fovea is placed a little in advance of the base on each side of the dorsal line, but nearer to the external margin than to the latter. Scutellum subsinuate-triangular, impunctate, with a slight depression on each side towards the base. Elytra glabrous, long, broad and depressed, black, with a very slight bluish-green tinge at the base and margins, punctate-striate, the striæ deep, but the punctures in them rather faint and transverse; the interstices convex and impunctate; the marginal space pubescent, finely punctate, with a few larger depressions; remains of pubescence are also seen springing from the punctures in the striæ; the apex is only slightly emarginate. Under side piceous; prosternum smooth, with a few scattered punctures on the sides; mesosternum more so, and metasternum, episterna, and abdominal segments with a fine granular or papillose punctuation, most marked on the sides. Legs rufescent, with the knees and tarsi somewhat darker.

I have named this fine species (the largest of the *Chlaenii* which I have received from Old Calabar) after the Rev. Hope M. Waddell, one of the most zealous and able of the missionaries who have done so much both for natural science, civilization and religion in this interesting region.

DILOBOCHILUS, Laferté, Ann. Soc. Ent. France, (2 sér.) ix. 293.

1. *D. Westermanni*, Laf. Rev. et Mag. d. Zool. 1852, p. 67.

Tomochilus Westermanni, Laf. loc. cit.

Capite thoraceque viridi-æneis, nitidis; thorace subquadrato, antice angustiore, sparse et sat profunde punctato, ad basin utrinque foveis profundis longitudinaliter impresso; marginibus rubro-cupreo micantibus; elytris nigris et opacis, striato-punctatis; interstitiis parum elevatis, geminato-punctatis, alternis aureo-cupreo micantibus, margine viridi-cupreo splendente; subtus niger; antennarum basi, palpis, ore et pedibus testaceis.

Long. 7½ lin., lat. 3 lin.

This beautiful insect, when in good preservation, is readily recognized by the alternate interstices shining with a metallic lustre. It, however, sometimes arrives in a rubbed or greasy state, when the metallic lustre is almost entirely effaced from the interstices.

ECCOPTOMENUS, Chaud. Bull. Mosc. 1850, No. 2. p. 409.

Hoplogenius, Laf. Ann. Soc. Ent. Fr. (2 sér.) ix. p. 237.
Chlænius, Bon. Dej.

1. *E. eximius*, Dej. v. p. 612.

Chlænius diaphanicollis, mihi, Annals, vol. xix. No. 114. tab. 13. fig. 11.

Capite æneo-virescenti, vix punctulato, mandibulis ferrugineis, labro et clypeo, palpis et primis duabus articulis antennarum testaceis; thorace parum circulari, antice emarginato, postice truncato, pubescenti, confertissime leviter punctato, ferrugineo-flavo, postice et in medio fuscescenti; lateribus reflexis ut in *Agono*, translucensibus; elytris latis, subdepressis, leviter punctato-striatis, obscure nigris, cum margine, macula humerali, macula transversa fere ad medium, et macula communis cordiformi ad apicem positis, omnibus junctis ad lineam marginalem, ferrugineo-flavis; interstitiis non punctatis sed leviter et irregulariter transverse aciculatis; subtus niger, cyaneo-iridescentis; prosterno lateribus testaceis; pedibus testaceis.

Long. 8 lin., lat. $3\frac{1}{4}$ lin.

I had figured this species under the name *Chlænius diaphanicollis* in the Plate above referred to, which accompanied a previous part of this list. Since then, I learn from M. de Laferté, who possesses the original specimens which belonged to the Count Dejean, that it is identical with the *Chlænius eximius* of that author, to which I have accordingly restored it.

My specimens, however, seem to differ somewhat from the normal type of Dejean. In his the thorax is darker in the middle, while in mine a blackish tint invades both the middle and the base. The yellow markings on the elytra also are not confined to the interstitial spaces specified by Dejean; but as I find my examples to vary in this respect, some having the markings more expanded than others, it is obvious that such differences are not specific.

ECTENOGNATHUS, mihi (*ἐκτενῆς* and *γνάθος*).

Mentum dente medio simplice. Palpi tenues, elongati et subcylindrici (articulis ultimis adhuc ignotis). Mandibuli valde projicientes, elongati, fortiter arcuati et apice acutissimo. Maxillæ spinis paucis armatae. Labrum subquadratum, postice parum angustatum, levissime emarginatum. Antennæ filiformes, articulo tertio cæteris longiore. Prothorax subcordatus, antice emarginatus, postice truncatus, margine re-

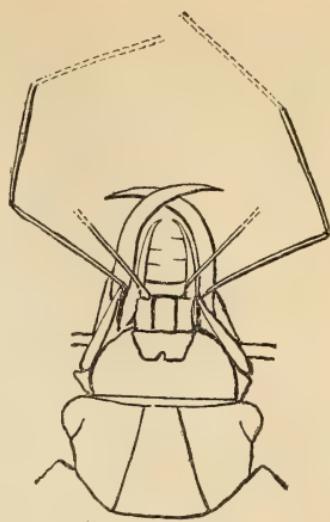
flexo. Elytra prothorace latiora, quadrato-ovalia, parum convexa. Tarsi marium ignoti, foeminarum ut in cæteris generibus *Chlaenii-darum*.

1. *E. Dryptoides*, mihi.

Supra nigro-virens et satis opacus, subitus niger et politus; capite antice, ore, gula, suturæ apice et pedibus testaceis; capite postice leviter granuloso, antice impunctato; thorace fortiter et dense punctato, margine late et profunde reflexo; elytris opacis, leviter punctato-striatis, interstitiis transversim papillose punctatis atque transversim levissime aciculatis; subitus prosterno leviter punctato, mesosterno et metasterno fortiter punctatis.

Long. $6\frac{1}{2}$ lin., lat. $2\frac{1}{2}$ lin.

Rather narrow; greenish black and opaque above, black and polished below; the anterior part of the head, the basal joint of the antennæ, the parts of the mouth, the throat, the extreme margins of the sides of the thorax, the reflexed margin of the elytra, particularly towards the apex, and a narrow margin on their sides and suture near their apex, and the legs, testaceous. Head finely granulose behind, smoother on the vertex, which is somewhat raised; front smooth and impunctate, with a transverse shallow depression in the middle opposite the anterior part of the eyes, an irregular depression and some granulose punctures on each side close to the base of the antennæ; the greenish colour of the head advances in the centre as far forward as the front of the eyes, but the testaceous colour passes backward on each side as far as the middle of the eye; the apex of the mandibles and of the joints of the palpi is darker than the rest; clypeus rather broad; labrum quadrate, somewhat broadest in front, with a large shallow depression in the centre (but I am doubtful whether this is not owing to an accidental crushing in my specimen); antennæ dark fuscous, the basal joint, and possibly the second, which is the shortest, more or less testaceous; eyes moderately prominent. Thorax subcordate, not without resemblance to the thorax in *Agonum*, coarsely and granulately punctate, so as to appear opaque; margins rather broadly reflexed, especially behind, with their edges narrowly semitranslucent and testaceous; dorsal line well marked, but



reaching neither to the front nor back; a depression across the base, and a sinuate fovea on each side within the reflexed margin, deepest and widest behind, following the outline of the margin for two-thirds of the length of the thorax. Scutellum small, triangular, finely granulose, elongate-oval, somewhat quadrate towards the shoulders and apex. Elytra opake, flattish on the disk, convex on the sides and apex, punctate-striate, the striæ and punctures fine; the interstices flat, transversely rugosely punctate, giving the appearance of the elytra in *Drypta*; under a powerful lens, the rugosity of the punctation is seen to be caused by the punctures having been made as it were from behind, so that in front of each there is a slight papillose elevation: besides this punctation, there is a very fine transverse aciculation; and there is a fine short pubescence proceeding from the punctures along the sides, which probably in fresh examples will extend over the whole elytra; the scutellar stria extends nearly a fourth of the length of the elytra, and the narrow edging of testaceous along the suture at the apex, which scarcely goes beyond the first stria, extends forwards about the same length. Under side polished, shining; prosternum very sparingly and faintly punctate; mesosternum and metasternum roughly and rather closely punctate; segments of abdomen faintly rugose, particularly at the sides.

I have only received a single specimen of this interesting species, and, unfortunately, the last joints both of the palpi and antennæ are wanting; but there remain sufficient characters of generic importance to enable me to allot it a place as a new genus of the *Chlæniidæ*.

OODES, Bon.

1. *O. obesus*, mihi.

Latus, convexus, niger, subnitidus, impunctatus, lœvis; antennis palpisque piceis; mandibulis piceis, planis, margine exteriore reflexo; thorace marginibus (præcipue antice) depresso, linea sublaterali arcuata; elytris punctato-striatis, intersticiis convexis; tarsis piceis, anticis pallidioribus.

Long. $5\frac{1}{2}$ lin., lat. $3\frac{1}{2}$ lin.

Broad and convex; black, smooth, and impunctate, with a dull, somewhat silky lustre, occasioned by a very fine aciculated punctation, scarcely visible except under the compound microscope. Head smooth, with a slight depression along the front, and with two small pits between the eyes; middle tooth of the mentum with a tendency to become bifid; antennæ piceous, first three joints shining, the rest pubescent and more dusky; palpi piceous; mandibles piceous, flat, rather thin, circular exteriorly, straight interiorly, except at the point, which has a rounded tooth;

exterior margin slightly raised and reflexed posteriorly; clypeus slightly emarginate, with a deep square depression in the middle of the anterior margin, and two large foveæ in each of the anterior angles. Thorax convex, without marginal line, except a very faint one on each side in front, with a linear depression from each anterior angle reaching almost to the basal margin, curved inwards, deepest in front, and leaving a broad marginal space widest behind: the appearance of this line reminds one of a bridle lying on the neck of a horse; it is, however, very faintly recurved near the base: dorsal line faint, reaching neither to the anterior nor basal margins. Scutellum large. Elytra punctate-striate; interstices convex; the short scutellar stria along with the sutural stria converging to meet the third and fourth striae at the base; the second stria straight; the striae deepest towards the apex, which is slightly sinuate. Under side with the episterna and sides of the metasternum punctate; sides of abdomen slightly punctate; the prosternum slightly prolonged behind, with the prolongation margined. Tibiæ short; anterior tibiae broad and triangular; anterior tarsi piceous, in the male with the first three joints very broad and transverse, and the fourth very small.

The most striking character in this species is the form of the mandibles and the projecting prosternum; the former might perhaps justify its establishment as a subgenus, and the latter would seem to approach it to the genus *Lonchosternus* of Laferté, of which the only character differentiating it from *Oodes* is the prosternum prolonged as in *Hydrophilus*. The projection here has no pretensions to such an extensive prolongation, but it may be viewed as the passage leading to it. The species is readily recognized by these characters, and by the bridle-shaped depression on the thorax.

2. *O. politus*, mihi.

Niger, nitidus, impunctatus, politus; antennis fuscis, ad basin ferrugineis; mandibulis ferrugineis, acutis, supra haud convexis; capite et thorace lœvissimis, hoc stria marginali tenui laterali et anteriori; elytris politis, leviter striato-punctatis, intersticiis planis, spatio marginali opaco, ad apicem latiore.

Long. $4\frac{1}{2}$ lin., lat. 3 lin.

Black, shining, impunctate, and polished. Head smooth, with scarcely any depressions; antennæ with the first three joints ferruginous, rest dusky; palpi piceous; terminal joint of maxillary palpi elongate and ovato-cylindric (rest wanting in my specimen); mandibles ferruginous, darker at tip, small, not convex, triangular, making the muzzle sharp, nearly straight on the outer side, slightly curved and without teeth on the inner; clypeus large,

transverse, scarcely emarginate; mentum with a strong middle tooth, and the lateral lobes large, acute, and with a conical outline; ligula as in the rest of the *Chlaeniidae*, free at its extremity, and cut straight. Thorax smooth, convex, and with a faint thin stria along the lateral and anterior margins, none on the basal. Scutellum rather large. Elytra delicately punctate-striate; interstices flat and shining; the scutellar stria along with the first and second converging at the base to meet the fourth, the third straight; a marked opake and rugose marginal space surrounding the sides and apex of the elytra, widest at the apex; the margin of the rest of the elytra touching this space sharply defined, so that the polished disk seems to lie on the top of an under opake layer; the apex slightly sinuate. Under side with scattered punctures, except along the middle; the prosternum somewhat projecting and slightly grooved, as in last species. Legs piceous (the anterior legs are wanting in my specimen).

I have only received one imperfect specimen of this species; and the want of its anterior legs, combined with the somewhat different form of the mentum and terminal joint of the palpi, prevent me referring it with absolute certainty to this family; but I have no doubt, from its general facies, taken along with the other characters which remain, that I have placed it correctly.

Cratoceridæ.

DIATYPUS, mihi.

(From διατυπόω, alluding to its being the representative in Africa of the genera *Daptus*, *Geopinus*, *Agonoderus*, &c.)

Mentum breve, profunde emarginatum, dente medio curto et obtuso, lobis lateralibus latis, fortiter extus rotundatis. Ligula parva, ad basin coarctata, ad apicem truncata. Paraglossæ dilatatae, rotundatae. Articulus ultimus palporum maxillarium ad basin cylindricus, in medio tumidus, ad apicem acuminatus; articulus ultimus palporum labialium similis, sed minus tumidus et minus acuminatus et truncatus. Mandibuli fortes, densi, dexter intus bidenticulatus, sinister unidenticulatus. Labrum quadratum. Caput mediocre, haud retro coarctatum. Oculi satis prominentes. Antennæ ad instar capitis et prothoracis longitudine; articuli primi, tertii et quarti longitudine æquales, cæteris longiores, et, cum secundo (breviore), obconici, quinti et sequentes parum depresso. Prothorax subquadratus, parum retro coarctatus; anguli antice rotundati, postice distincti. Elytra prothorace paullo latiora, parum elongata, parallela, ad apicem sinuata. Pedes mediocres: tibiæ anteriores parum dilatatae et versus apicem extus denticulatae; tibiæ intermediæ et posteriores haud denticu-

latæ; tarsi subtus fortiter ciliati, anteriores et intermedii maribus dilatati, articulis quatuor primis triangularibus, primo longiore, quarto bilobato in omnibus tarsis, posterioribus haud dilatatis. Corpus satis elongatum.

In general appearance the species composing this genus approach nearer to the American genus *Geopinus* than to any other which I have seen, but are readily distinguished from it by the possession of a median tooth to the mentum, besides the other characters above mentioned; their form also is less convex, and approaches more nearly to *Anisodactylus*. The place of the genus seems to be next to Dejean's and Schmidt-Goebel's Indian genus *Batoscelis*, as defined by Lacordaire, from which it differs in the following respects:—its mentum is deeply, instead of being feebly emarginate; its ligula is small, instead of being “assez grande;” its paraglossæ are rounded instead of being truncate, and can scarcely be called arched. In other respects the characters seem almost the same. The bilobed fourth joint of the tarsi is not noticed in Lacordaire's description. Probably it would have been better for me to have widened the characters of the genus *Batoscelis*, so as to have admitted the following species, instead of making a new genus for them; but the difference of their native country has induced me to separate them.

1. *D. Dohrnii*, mihi.

Fusco-virescens; antennis, clypeo, mandibulis palpisque ferrugineis; capite polito, foveis duabus inter oculos linea antica transversa junctis; thorace leviter marginato, lateribus depresso, angulis posticis foveolatis, disco leviter, lateribus fortius punctato; scutello impresso; elytris levissime punctatis, striatis, striis impunctatis, interstitiis leviter convexis; subtus fuscus, lateribus (episternis et epimeris) leviter et irregulariter punctatis, medio et ab domine impunctatis; pedibus pallidis.

Long. 5 lin., lat. $2\frac{1}{4}$ lin.

Above fuscous with a virescent tinge. Head polished and sparingly punctate behind the eyes, the rest impunctate, or nearly so; a deep angular fovea on each side near the inner corner of the eyes, united by a deep impunctate transverse line, in front of which the epistome is marked by a broad, transverse, somewhat rugose depression; antennæ, clypeus, palpi, and parts of the mouth more or less ferruginous; clypeus with a row of depressions in front, from each of which springs a hair. Thorax rather convex, with a broad well-defined depression along the margins and angles, broadest at the posterior angles, and bordered all round with a slight raised edging; slightly punctate on the disk, more deeply so on the depressed margins; the dorsal line is feebly punctate-striate, and reaches only to the anterior semi-

lunar depression, which is well marked ; the base is very slightly but broadly emarginate ; in front of the emargination is a sinuate transverse depression, on each side of which is a fovea ; the anterior angles are broadly rounded, the posterior are obtuse. Scutellum ferrugineo-fuscous, rugosely impressed. Elytra with a greater virescence than the head and thorax, very faintly punctate ; striate, but without punctation in the striae ; the interstices slightly convex ; two or three slight foveæ on the outer side of the second stria, one about a third from the base, the next about a third from the apex, and the last about a sixth from the apex ; a number of pits are placed at irregular distances along the marginal space. Under side fuscous, paler than above, and not virescent ; the middle and the abdomen are not punctate, but the side-pieces (episterna and epimera) are all faintly and irregularly punctate. The legs are pale testaceous.

I have named this species after Herr Dohrn of Stettin, an entomologist of world-wide reputation, whose great attainments as a man of science are only equalled by his genial and endearing qualities as a friend.

2. *D. Smithii*, mihi.

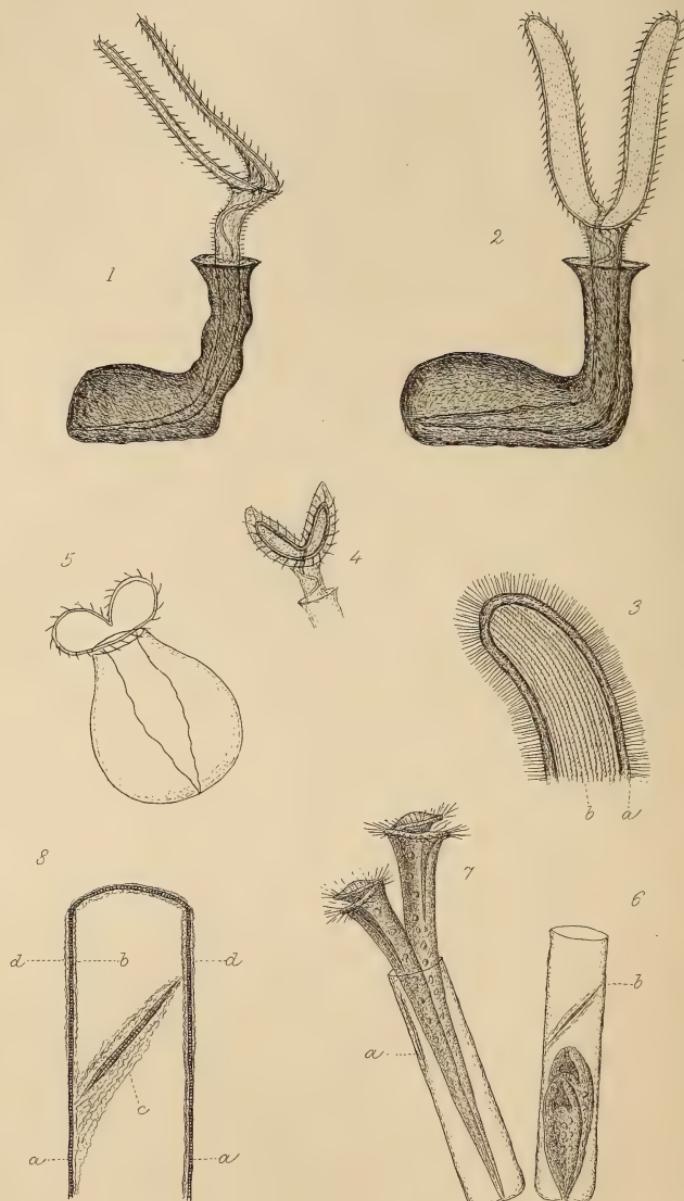
Præcedenti similis, sed major ; niger et haud virescens ; capite linea transversa antice multo minus profunda ; thorace disco impunctato, angulis posticis minus obtusis, ad mucronem fere rectis ; elytris interstitiis impunctatis, striis profundioribus quam in *D. Dohrnii* ; subitus vix punctatus ; cæteris ut in *D. Dohrnii*.

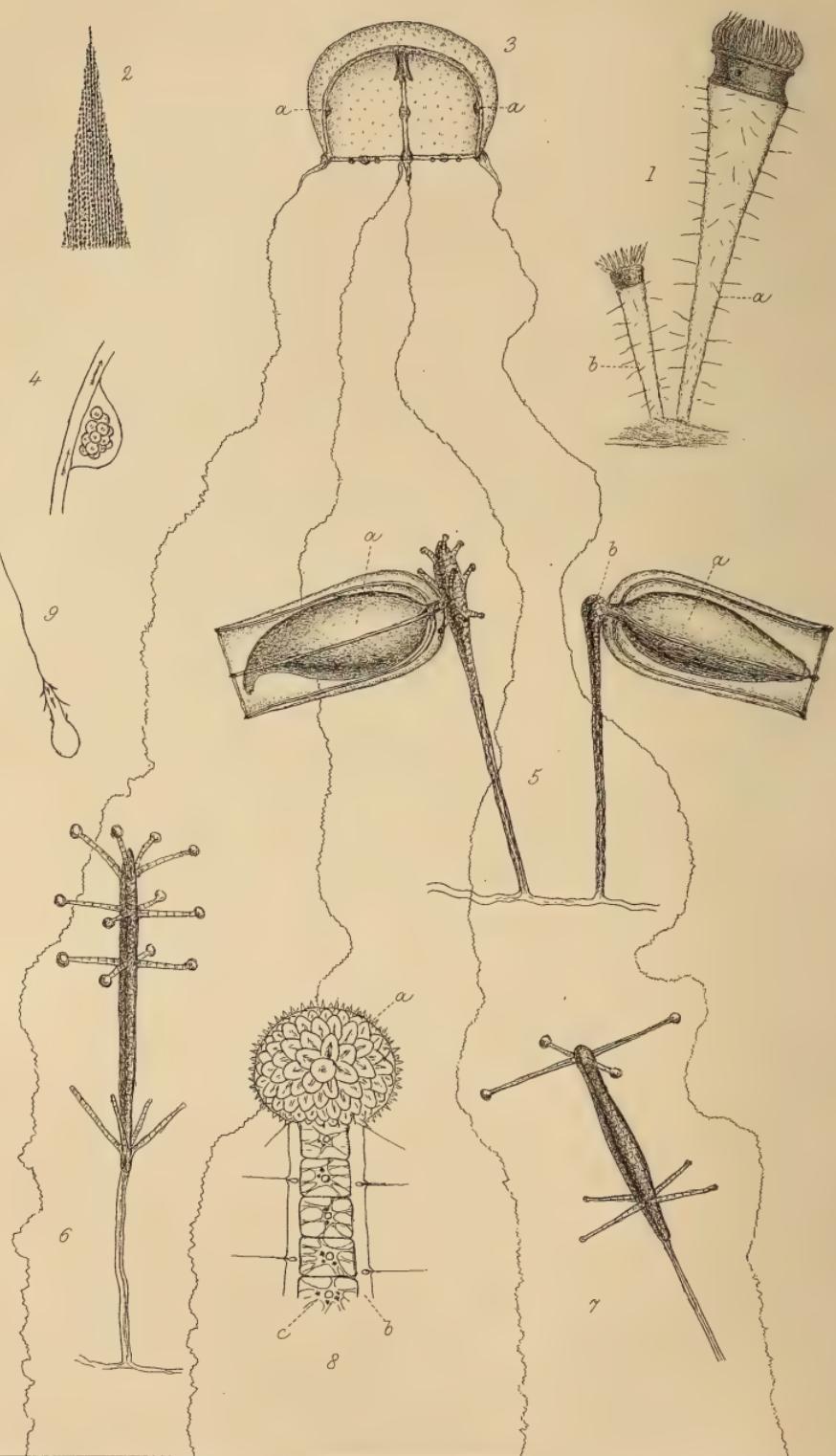
Long. 6 lin., lat. $2\frac{1}{2}$ lin.

Closely allied to the preceding, but differs from it in the following particulars. It is black instead of virescent fuscous. The head is wholly impunctate ; the angular depressions in front are shallow, and united by a faint transverse line instead of a deep groove, and the epistome has scarcely any depression. The thorax is impunctate on the disk ; the dorsal line is scarcely punctate, and it reaches wholly to the front, the posterior angles are less obtuse than in *D. Dohrnii*, and somewhat sinuate, so as at the very point to be almost right-angled for a short space. The elytra are more deeply striate, and the interstices more convex and impunctate. The under side has scarcely any punctuation at all, either on the sides or middle. In other respects the same description will apply to the two species.

I have named this species after my friend Mr. Frederick Smith of the British Museum, whose kindness places the extensive information he possesses at the disposal of all who desire to profit by it.

[The continuation of this Paper will appear in the next Number of the Society's Transactions.]





T. Strethill Wright etched on stone!

Scherck & McFarlane, Lith. Edin.

1. 2. *Ephelota coronata*.3. 4. *Campanularia Johnstoni*.5. *Coryne gravata*.6.-8. *Stauridia producta*.

II.

Description of New Protozoa. 1. *Lagotia viridis.* 2. *Vagincola valvata.* By T. STRETHILL WRIGHT, M.D., Fellow of the Royal College of Physicians, Edinburgh.

[Read 25th March 1857. See p. 258 *ante.*]

EXPLANATION OF PLATES.

Plate XVIII.

Fig. 1. *Lagotia viridis*, showing rotatory organ from lateral aspect.
 2. Front view of *do.*
 3. Tip of one of the lobes of rotatory organ—*a* large ciliary band—*b* striæ bearing cilia.
 4. Young animal of *L. viridis*.
 5. *Vagincola ampulla* (Müller).
 6. *Vagincola valvata*, animal extended, and (7.) contracted—*a* valve raised—*b* *do.* closed.
 8. Diagram of upper part of tube of *V. valvata*—*a* tube—*b* sarcode lining *do.*—*c* valve closed—*d* sarcode coating tube on outside.

Plate XIX.

Fig. 1. *Ephelota coronata*—*a* with tentacles contracted—*b* with *do.* expanded.
 2. Diagram of tentacle of *E. coronata*.

I. *Lagotia viridis.*

Family *Ophrydina*—Genus *Lagotia*.* (Mihi).

Lagotia viridis. (Plate XVIII., figs. 1, 2.) This remarkable member of the *Ophrydina* was discovered about two years ago, occurring in great profusion on a shell dredged up from the Firth of Forth. It rapidly multiplied itself until it studded the sides of the vessel in which it was kept, and various *Algæ* contained therein, with its dark-green cells. In March last it was again dredged from the same locality.

In general appearance the animal resembles *Vagincola*, though it differs from that genus in some important particu-

* λαγός, a hare; ὄτιον, an ear-flap, an ear.

lars. The cell resembles an amphora or flask lying on its side, having the neck bent more or less sharply upwards, and dilated into a trumpet-shaped mouth. Its colour is dark sea-green, in the larger specimens nearly opaque. The transparent green animalcule is long and cylindrical, as in other genera of the family Ophrydina, and is attached by its posterior extremity to the bottom of the tube. Its anterior extremity is crowned by a rotatory organ, the form of which is unique among the Protozoa, but which is the homomorph of the hippocrepian type, occurring in *Alcyonella* and others amongst the Polyzoa, and in *Phoronis* amongst the Annelida. This organ, when seen in front, and erect (fig. 2), appears like a narrow horse-shoe; whilst from the side the anterior extremity of the animalcule bears a resemblance to the head and ears of a hare. A thick muscular (?) band passes round the border of the horse-shoe, and forms the basis of a wreath of long vibratile cilia (fig. 3), the motion of which produces the optical illusion of moving cogs or teeth. The whole surface of the body and rotatory organ is seen (under a power of 300 diam.) to be striated with fine lines, which bear cilia in most active motion. The gullet (?) in the first specimen taken, was, in every case examined, a shallow sac placed within the bend of the horse-shoe and between the ciliary bands; but in the last batch of specimens, which were of much larger size, it invariably passed deeply within the body as a tapering canal, in which the motion of large cilia could be clearly detected.

Although both colonies were exceedingly numerous, and lived a considerable time with me, I was never able to discover their mode of increase. They were never seen double—"two single gentleman rolled into one"—as the convivial *Vagincola* appears to be when undergoing multiplication. Two *Lagotias*, indeed, keeping house in the same bottle would doubtless lead a most unhappy life. The single tenant is an ill-conditioned and restless fellow, constantly rotating this way and that, and wagging his long ears; and, when sitting for his portrait, assuming as many changes of character as Charles Matthews himself.

The colour of the body of *L. viridis* is not caused by an

accumulation of green granules as in *Stentor Ophrydium* and *Vorticella*, but is a transparent and uniform staining of the sarcode—a lighter tint of that of the cell.

In young specimens found growing amongst the second batch, the lobes of the horse-shoe were blunt and short, and the ciliary band placed at a little distance from their edges, as in fig. 4.

L. hyalina.—Colourless; lobes of rotatory organ wider and blunter than those of *L. viridis*. Cell buried in the substance of *Alcyonidium hirsutum*, and therefore not seen. Found at low-water, Granton and Queensferry. Not uncommon.

L. atro-purpureus.—Colour of animal that of a mixture of ink and water. Cell yellowish-brown. Probably a variety in colour of *L. viridis* with which it was found.

[Since the above was communicated to the Royal Physical Society, I have learnt from Mr Alder that he has occasionally seen *L. viridis*, and he has sent me drawings of specimens obtained in autumn last near Tynemouth. In these the spiral gullet does not appear. Mr Alder thinks that the animalcule sometimes burrows in the shells which it infests, as I have noticed in the case of *L. hyalina*.

At fig. 5 I have given a sketch of *Vagincola ampulla* (Müller), which has a bilobed rotatory organ, and so far bears some resemblance to *Lagotia*.]

II. *Vagincola valvata*. (Mihi). (Plate XVIII., figs. 6, 7).

This marine animalcule was found growing plentifully on the zoophytes and sea-weeds in one of my tanks. It resembled *Vagincola crystallina*, an inhabitant of fresh water, except in its being colourless, whilst *V. crystallina* contains globules of green matter. It possesses another remarkable distinction also from *V. crystallina*, in the presence of a valve (*a*) situated within its cell, which shuts down in an inclined position (*b*) over the animal as it retreats therein. On examining the valve *in situ* I found it to consist of a rigid plate, imbedded in a thick layer of transparent sarcode, which latter was continuous at the lower end of the valve, with a thin layer of the same substance, lining the whole of the interior, and coating the upper part of the exterior of the tube. The

valve was closed by a contractile process passing from its under surface (fig. 8, c.) to the wall of the tube. I have not been able to come to any conclusion as to the shape of the solid frame-work of this remarkable provision for closing the cell of this animalcule, as it is visible only in profile; but I am disposed to consider the whole apparatus to consist of an oval plate of soft sarcode, supported by an included bar or narrow plate of horn or chitine. It is evident that a rigid oval plate accurately closing the bore of the tube would be immovable.

The animal was generally double, as in the figures. In some specimens the tube was marked with close transverse or circular striae.

III.

Observations on British Zoophytes. 1. *Coryne gravata.*
 2. *Stauridia producta.* By THOMAS STRETHILL WRIGHT,
 M.D., &c.

[Read 22d April 1857.]

EXPLANATION OF PLATE.

- Fig. 3. Medusoid of *Campanularia Johnstoni*—*a* ovaries.
- 4. Ovary of *do.*, with ova.
- 5. *Coryne gravata*, with medusoids—*a* peduncle=sperm-sac—*b* polyp undergoing absorption.
- 6. *Stauridie* of Dujardin (after Gosse).
- 7. *Stauridia producta* single polyp.
- 8. End of one of the capitate tentacles of *S. producta*—*a* head covered with thick prehensile palpocils, and containing thread-cells—*b* ectoderm, with acuminate palpocils springing from tactile (?) corpuscles—*c* central chain of endodermal cells, with vacuolated contents, nucleus, and brown granules.
- 9. Thread-cell of *S. producta*, with thread exserted.

I. *Coryne gravata.* (Mihi). (Plate XIX., fig. 5.)

In the spring of 1856 I noticed, in a rock-pool near North Berwick, a number of small milk-white bodies, apparently floating in irregular lines, at about half an inch from the surface of the friable sandstone. When these were transferred to

the collecting-bottle, they were seen to be attached to the buccal papillæ of small coryneform polyps, and proved to be the greatly enlarged peduncles of fully-developed medusoids.

The polyps of the *Coryne* were colourless, with ten or twelve short capitate tentacles; the polyp-stalks smooth, about a quarter of an inch long, springing from a creeping polypary; the medusoids colourless, long, cylindrical, with four lateral canals and four rudimentary tentacles, represented by small bulbs containing brown pigment; the peduncle, pyriform, inflated,—nearly filling the cavity of the sub-umbrella; the umbrella without thread-cells, wrinkled on its external surface.

Further observation showed that the peduncle of the medusoid, though still attached to the *Coryne* by a thick fleshy process, had become little else than a sac of spermatozoa, which were secreted between its ectoderm and endoderm. These membranes were continuous with each other at the mouth, where they were furnished with a ring of thread-cells.

In several cases the bodies of the *Corynes* had lost their tentacles, and were reduced by absorption to mere tubercles (fig. 5, *a*), the medusoids still remaining firmly attached; hence it is possible that the medusoids of this *Coryne* never become free.

In the "Annales des Sciences Naturelles," vol. xv., 2d series, Lowen has described a *Coryne* (*Syncoryne ramosa*) bearing a fixed medusoid, strongly resembling the above, with the exception that the peduncle contained ova instead of spermatozoa. I was at first led to believe that my *Coryne* was the *male* polypary of Lowen's *female*; but the wrinkled corallum, or polypidom of the latter, and the presence of thread-cells on the umbrella of its medusoid, indicate that the species, although similar, are distinct.

The "*Syncoryne ramosa* (Ehr.)" of Lowen, differs, I think, altogether from the *Coryne ramosa* described by Johnston as "*bipollicaris, hyalina, ramosa, ramulis basi contractis, capitulis valdè elongatis, prole in capitulo sparsa, (Ehr.)*" (a large branched *Coryne* with a ringed corallum, found in the Firth of Forth, and remarkable for the length of its cylindrical polyps, and the number of ovisacs or sperm-sacs scattered amongst its tentacles), and will have to be referred to a new species.

For the subject of this notice I propose the name of *Coryne gravata*.

The Rev. T. Hincks informs me that he has seen a *Coryne* with cylindrical medusoids resembling fig. 5, but he did not observe its sexual character.

II. *Stauridia producta* (Mihi).

In the "Annales des Sciences Naturelles," 3d series, vol. iv., p. 271, M. Dujardin remarks, "J'y vis une sorte de Syncoryne que j'ai nommée Stauridie à cause de ses quatre tentacules disposés en croix;" and he proceeds to describe the structure of the animal, and its reproduction by means of free medusoids, to which he gives the name of *Cladoneme*.

Mr Gosse, also, in his "Devonshire Coast," has described and beautifully figured the same animal, under the name of *Coryne stauridia*, or "the slender *Coryne*." This zoophyte, one of the polyps of which I have sketched at Pl. XIX., fig. 6., is remarkable, not so much on account of the cruciform disposition of its tentacles, as for the dissimilarity in character of those members; the upper row being capitate, as in the genus *Coryne*, while the lower are filiform and pointed, as in *Clava*, *Cordylophora*, &c.

The dissimilar character of the tentacles, however, must remove the animal of Dujardin from the genus *Coryne* or *Syncoryne*, and place it in a new genus, which will rank intermediately between *Coryne* and *Cordylophora* in the classification of Johnston. For this genus I propose the name "Stauridia," derived from Dujardin's *Stauridie*, although the construction of the word and its meaning are incorrect (*σταυρός*, *crux*, signifying a stake, of any shape, to which a criminal was nailed.)

The characters of the new genus are:—

Genus *Stauridia*.

Polypary sheathed in a tubular corallum or polypidom (branched, the apices of the branches) bearing polyps furnished with two or more whorls of dissimilar tentacles,—the upper whorl or whorls capitate, the lower whorl filiform, four in number. Thread-cells very large, many-barbed.

In the spring of 1857 I picked up, on the shore at Caroline

Park, near Edinburgh, a specimen of *Plumularia falcata*, on which grew a coryneform zoophyte belonging to the genus *Stauridia*. The polyps were very long and cylindrical, and furnished with twelve capitate tentacles, arranged in three whorls, and also with a fourth whorl of filiform tentacles, situated at a considerable interval beneath the third whorl, as shown in fig. 7. The filiform tentacles were held, not at right angles as in Dujardin's species, but at an acute angle with the body of the polyp.

The globular tips of the upper tentacles exceeded in size those of any of the *Corynes* with which I am acquainted, and contained many-barbed thread-cells (fig. 9), half a diameter larger than similar cells in *C. pusilla*. When first found, the smooth polyp-stems sprung singly from a creeping fibre; but after a few weeks of plentiful entomostracean diet, they became irregularly branched, as in Gosse's figure of *Coryne stauridia*.

I have named this species *Stauridia producta*.

S. producta.—*Polyps much elongated, cylindrical (reddish); capitate tentacles in two or three whorls; filiform tentacles semi-erect.*

Dujardin has described, in his *Stauridie*, the production of medusoids whose strange form and precautions for the safety of their ova are well worthy of note. I anxiously watched my *Stauridia* for many weeks, but it gradually died away, “without issue.”

The tentacles of *Coryne* and *Stauridia* are not hollow, but contain a core or central chain of endodermic cells, placed in single series (as at *c*, fig. 8). The contents of each of these cells consist of highly vacuolated sarcod, which includes a nucleus, accompanied by a few coloured granules, the function of which has not been determined. The ectoderm of the tentacle *b* is not generally vacuolated; it contains minute soft corpuscles (woodcut, fig. 2), from each of which projects externally a long and finely-acuminated spine or palpocil. These spines are also found scattered over the whole body of the polyp, unconnected with thread-cells, and are, I am led to believe, instruments of sense (touch?). The head of the tentacle *a* is covered with short thick palpocils, which I have

elsewhere considered as prehensile apparatus. These palpo-cils (woodcut, fig. 1)

arise each as a somewhat rigid process, from the side of one of the large thread-cells buried in the head of the tentacle, and they probably convey an impression from bodies coming into contact with them,

to the thread-cell, which causes the extrusion of its dart. The offensive character of the thread-cell, which has been denied (Lewis' "Sea-side Studies"), is proved by allowing any soft body, as the bulb of a human hair, to touch the tentacles of *Hydra*, *Coryne*, or *Actinia*, when it will afterwards be found studded with their darts buried beyond the barbs.

Fig. 1.

Fig. 2.

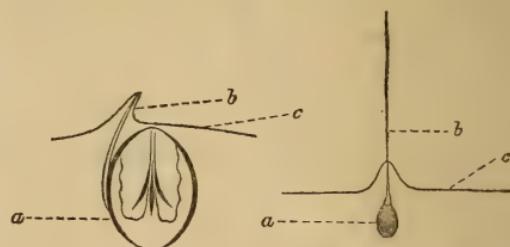


Fig. 1.—*a* thread-cell—*b* thick palpocil—*c* surface of head of tentacle.

Fig. 2.—*a* tactile corpuscle—*b* acuminate palpocil—*c* surface of ectoderm.

PROCEEDINGS
OF THE
ROYAL PHYSICAL SOCIETY.

EIGHTY-SEVENTH SESSION, 1857-58.

Wednesday, November 25, 1857. W. H. LOWE, M.D., President, in
the Chair.

The following Donation to the Library was laid on the table, and
thanks voted to the donor :—

Proceedings of the Berwickshire Naturalists' Club. Part. VII. of Vol.
III., 1856, and Part. I. of Vol. IV., 1857.

John Cleland, M.D., and E. W. Dallas, Esq., were elected Members of
the Society; Mr Richard Shield, Alpha Place, Kentish Town, London,
was elected a Non-Resident Member.

It was announced that the Rev. John Fleming, D.D., Professor of Natural Science, New College, late President of the Society, had died on the 18th November, and the members, after communication with the family, and in compliance with an invitation issued by the Secretary, had, on the 24th inst., joined the funeral procession on its way to the Dean Cemetery.

And it was agreed that the Society should, at this its first meeting, record the very high respect and regard in which the members held their deceased friend, and the deep sorrow they feel on the occasion of his sudden death. Dr Fleming was an active member of the Society while yet a student—was instrumental in resuscitating it after it had been nearly dormant for several years, and was twice elected one of the Presidents. He took the most lively interest in all the Society's proceedings, and was always ready to contribute papers, and to take part in the discussions. The rich and varied stores of knowledge which he possessed, obtained to a large extent through original observation and research, and eminently characterized by thoroughness and accuracy, were ever at the command of the

Society. In acquaintance with the natural history of Scotland generally, Dr Fleming has probably never been surpassed. His works on the "Philosophy of Zoology" and his Geological Papers are proofs of his taste and capacity for generalization ; while his " British Animals" shows at once his talent for description and his scrupulous regard to truth. This love of truth, for its own sake, occasionally led him into earnest contendings, in which he displayed no less self-mastery than skill, and as much generosity as straightforward honesty of purpose. Each member of the Society feels that, in Professor Fleming's lamented decease, he has lost a very dear and a much respected friend, father, and counsellor. His accessibility, his unvarying courtesy, and unvarnished kindness of manner, encouraged all who wished to consult him, while the fulness of his science, and his liberality in imparting it, rendered such an intercourse with him most satisfactory. In his capacity as Professor of Natural Science in the New College, it is believed that Dr Fleming has been eminently successful in imparting much of his own healthy spirit to the many students who have listened to his prelections, while his own full testimony to the compatibility of a sincere belief in revealed truth with acceptance of the facts and views of modern science, must have helped not a little to stem the torrent of speculative infidelity which threatened not long since to break forth in our land.

The Secretary was instructed to forward copies of this minute to Mrs Fleming, and to his son, Dr Andrew Fleming, H.E.I.C.S., as an expression, on the part of the Society, of sincere sympathy with them in their bereavement.

I. The PRESIDENT then delivered the Opening Address.

Dr Lowe, the President who retires, delivered an address bearing on the present state and prospects of the Society in those branches of science more particularly cultivated by its members. In doing this, he alluded to the annual addresses already delivered from that chair by Hugh Miller, and, alas ! as he was now compelled to say, by "the late" Professor Fleming, as well as those by Dr Greville, Dr Coldstream, Mr Chambers, and others. He then briefly alluded to the alternate eras of prosperity and depression which have been the lot

of the Society, now nearly ninety years old, and reminded his hearers that it was in one of those periods of comparative desuetude that our revered and lamented friend Professor Fleming, so very recently snatched from among us, had collected, as it were, its scattered materials, and renovated once more its strength. Were it for no other reason, it would be but natural for us, who now mourn his irreparable loss, to seize this the first opportunity of testifying to his worth. "Sure I am," said he, "that but one feeling pervades the minds of those present, and that is, how can we best declare the feelings of sorrow, affection, and regard which we entertain for his memory. I would venture to say, there is no method which could have better pleased him than carrying out the legitimate aims of this Society, itself his peculiar object of regard. I say, the legitimate aims of the Society; for though some may think that such societies are for the exhibition of ingenious papers, or the mere unravelling of a piece of anatomy, there is a far higher and a more enduring object than that, in the diffusion of a knowledge of natural history; and it is with pleasure I recal to your minds the remarks made by my friend Dr Coldstream from this chair, in which he congratulated the Society on the healthy tone which has ever prevailed in the papers laid before it, and the desire ever manifested by its members to make "that power, and wisdom, and unfathomable perfection" which pervades each created thing, redound to the praises of the one infinite Creator of all things. Thus, to carry out the objects of the Society, would, I am persuaded, be acting most in accordance with the wishes and desires exhibited here by our lamented friend, and would, I humbly conceive, be doing the truest honour to his name and memory. I shall not, gentlemen, dwell longer on the irreparable loss we have sustained; for I feel entirely unequal to say anything adequate to the sad occasion; but in turning from this mournful page in our history, I cannot but remark on the number of distinguished men, either connected with this Society or cultivating kindred pursuits, which a few short years have swept from our view, Dr Patrick Neill and Sir John Dalyell are names first in our memories, and around the grave of Edward Forbes were gathered Hugh Miller, Dr Johnstone of Berwick, and Professor Fleming."

Dr Lowe then went on to allude to the "Proceedings," the publication of which had marked the last session ; and while he highly complimented the Society on the production of so creditable a fasciculus, he earnestly enjoined upon the members to spare no exertions to ensure their continuance. He further alluded to the very common position of members of the Society, who, while they were by taste and inclination devoted to the pursuit of natural history, were nevertheless, by their professional and domestic duties, prevented from following out with any degree of regularity the various branches of science which they desired ; he reminded such how much might be done by "a habit of keeping their eyes open," and in illustration of this, quoted some amusing instances related by the late Bishop of Norwich, Dr Stanley, and, in addition, he begged to give one on his own part, and that was, the finding of *Achatina acicula*, which, as far as he was aware, had not been before noticed in Scotland. This rare but minute shell he had first noticed one day during the past summer while removing a decayed plant in his own flower-garden at Balgreen, and on subsequent investigation had found it generally distributed throughout the garden. He had sent specimens to the late Professor Fleming, Mr P. Dalmahoy, and Mr A. Bryson, none of whom had ever seen this mollusc alive, nor indeed in its living condition had it ever been seen in Scotland, and only rarely in England, though in the dead state it is found in the latter country very abundantly.

After exhibiting specimens of these shells, and remarking on the necessity of constant moisture in order to preserve them alive, he contrasted some specimens of *Clausilia*, picked up on Mount Carmel by Mr Henry Paul in 1856, and which he had presented to Dr Lowe in 1857. These apparently dry shells Dr Lowe had placed in tepid water only two days previously, and he now showed seven healthy molluscs creeping about in the glass before him, after what might be called a hybernation of about two years ! Dr Lowe concluded by thanking the members for the kindness he had ever experienced from them during the period he had held the honourable office of one of their Presidents, which office he now begged to resign.

II. Contributions to the Natural History of the Hudson's Bay Company's Territories. Part I.—*Rein-Deer.* By ANDREW MURRAY, Edinburgh.

Perhaps I may be allowed, before proceeding to the proper subject of this paper, to say a few words in explanation of the somewhat ambitious title I have given to it, and of how I come to be in a position which entitles me, with a reasonable prospect of keeping the promise thereby implied, to offer the *first* part of “Contributions to the Natural History of Northern America.”

In the Hudson's Bay Company's charter, which was granted by Charles II. in the year 1670, the preamble, or narrative of the cause why it was granted, bears that certain individuals had, “at their own great cost and charges, undertaken an expedition for Hudson's Bay, in the north-west part of America, for the discovery of a new passage into the South Sea, and for finding some trade for furs, minerals, and other considerable commodities, and by such their undertaking, have already made such discoveries as do encourage them to proceed further in pursuance of the said design, by means whereof there may probably arise very great advantage to us and our kingdom;” therefore his Majesty had resolved to grant them the tracts of land therein specified, and the sole trade and commerce thereof.

This, it will be seen, was no condition that the Company should do anything for science, or future expeditions, or discoveries. Whatever was the motive which led to the charter being granted, the grant itself was unfettered by any restriction or condition relating to such matters.

The Company, however, has always acted as if the motive which may have led to the grant, viz., the merit of past and the hope of future discoveries had imposed an express obligation on them to do everything in their power to foster researches in the dominions so conferred on them.

The extent to which the assistance of the Company has thus been given to science cannot be estimated; but it is not too much to say, that no public or private expedition was ever conducted through their territories which did not draw largely upon the

liberality and assistance of the Company. Their own numerous explorations, their extensive geographical surveys, and the able and ready help which they have given to the search after Franklin and his crew, are instances which it is scarcely necessary to recal to the mind of the reader. I have, however, had special opportunity of seeing the liberal mode in which they extend their assistance to scientific objects, on the occasion of a botanical expedition being sent out a few years ago by an association formed in this city, to procure seeds of new and valuable hardy trees and plants from Oregon and the neighbouring districts. I acted as secretary to that association, and conducted the negotiations with the Hudson's Bay Company for securing their assistance to the collector (Mr Jeffrey). The liberal spirit in which I then found that the Company looked at things impressed me not less than the extent of the power they possessed. But there were other things which struck me with equal force. In studying the route followed by Jeffrey, I had the enormous extent of their territory forced strongly upon my attention—thousands of thousands of miles still inhabited only by the “wild ;” and all this territory dotted over by the trading or hunting stations of the Company. I found also, in the occasional correspondence I had with the officers stationed at some of these remote posts, that they were obliging and intelligent. I imagined that many of them (from their hunting propensities, which may have led them to the life they followed) must have an instinctive taste for natural history ; and when I put all this together, I felt that here was a great opportunity for enlarging our knowledge of the natural history of a considerable portion of the globe, which was lying fallow only because no one advanced his hand to seize it.

Seeing that no one else did so, I resolved to try what I could do myself, and I applied to the Governor and directors of the Hudson's Bay Company for permission to circulate throughout the posts scattered over their territory a paper which I prepared, entitled, “ Instructions for Collecting Objects of Natural History ;” in which, in few words, I gave general directions for collecting, preserving, and sending them home ; and concluded by requesting those officers of the Hudson's Bay

Company who might have a taste that way, to aid me by collecting for me, and transmitting to me the proceeds of their exertions.

Through the kind assistance of Mr Edward Ellice jun., my application was favourably received; and the Governor and directors not only sanctioned the distribution of my circulars, but charged themselves with it, and undertook to forward to me any collections that might be made,—the only condition imposed being, that the officers of the Company should not allow such collecting to interfere with the proper duties of their stations.

Five hundred copies of my instructions were accordingly sent out last year, and scattered over the length and breadth of the land; and the first-fruits of the seed so sown is the arrival, a few weeks ago, of six cases containing different objects of natural history, a portion of which will furnish the text for this paper.

I begin with the largest objects, viz., four magnificent heads and antlers of rein-deer, which have suggested some remarks on the disputed point of the identity of the European species with that of America, and on one or two other points of incidental interest.

The specimens received were sent by Mr Hargrave of York Factory. In his letter announcing their despatch, he says,—"Since writing the above, I have received from our trading station at Church-hill some specimens of "*Esquimaux*" rein-deer horns, obtained from the natives who visit that post from the south shores of Chesterfield Inlet,—two pairs of the handsomest of which, and two more from their very peculiar shape, I have caused to be bound into two bundles, under your address, and will ship them to London next month." It thus appears that the locality from which they come is that known as the Barren Ground, which is that sterile district forming the northernmost part of Canada, and bordering the shores of the Icy Sea, and that they belong to the variety described by Sir John Richardson under the name of "*Cervus Tarandus*, var. *a. arctica* (Barren Ground caribou)." Whether that variety is or is not a distinct species is a question still open among naturalists. The weight

of opinion certainly is in favour of its being merely a variety, and not a species. Sir John Richardson himself treats it as a variety; but at the same time he says (*Fauna Boreali-Americanæ*, vol. i.), "The rein-deer or caribou of North America are much less perfectly known (than the European). They have, indeed, so great a general resemblance in appearance and manners to the Lapland deer that they have always been considered to be the same species, without the fact having ever been completely established;" and again, in speaking of the two North American varieties which he describes,—viz., the Barren Ground caribou, and the Woodland caribou, he says, "Neither variety has as yet been properly compared with the European or Asiatic races of rein-deer, and the distinguishing characters, if any, are still unknown." Colonel Hamilton Smith, in Griffith's edition of Cuvier's *Animal Kingdom*, had previously spoken much in the same doubtful way, but still had not ventured to erect the varieties into species. He said, "The North American reindeer or caribou are still very imperfectly known. There appear to be three varieties, one or more of which may actually form different species." The most recent evidence on the point, however, is that of Dr Gray, who, in his *Catalogue of the Specimens of Mammalia in the British Museum (Ungulata furcipedæ)*, 1852, has included the North American rein-deer, along with the Lapland rein-deer, under the old name of *Tarandus rangifer*, noticing them only as varieties. It does not matter whether we take this as an evidence of the views of naturalists in general at that date, or merely as the expression of the opinion of Dr Gray himself. No one ought to oppose the general opinion of concurrent naturalists, or the individual opinion of such a man as Dr Gray (admittedly one of our first living mammalogists), without at least distrusting his own judgment, and carefully weighing the arguments for and against the opinion which they have sanctioned by their authority; and it is only after having done so, to the best of my ability, that I have come to a different conclusion.

The grounds on which these naturalists retain the American as part of the European species are wholly negative. They do not find any differences sufficient to constitute specific cha-

acters. Let us, therefore, see what the differences in the characters of the two varieties really are, and examine their extent and value.

In the first place, the form of the horns is different. Sir John Richardson, indeed, by way of qualifying the value of this character, says, "It is to be recollectcd, however, that the antlers of the rein-deer assume an almost infinite number of forms, no two individuals having them alike." True; and the same may be said of the characters of all variable species; but in them, as in the rein-deer, there *is* a character of form which, constantly varying in individual detail, is constantly permanent in the general effect. The Lapland deer have one character, the North American another. Sir John Richardson gives figures of two heads of Barren Ground rein-deer, and although the minute details somewhat vary from those I received, the general effect is so much the same, that the figures of the one and the other might be taken for the first two heads sent to me by Mr Hargrave, one of which is figured below (fig. 1).



Fig. 1. (North American Species.)

The most characteristic points in the American species are the triangular-bladed brow antler, the longer and more slender stem, and the fewer processes; but the first of these

(the brow antler) is that on which I would chiefly rest, for it is a structure prepared and adapted to a condition of life, and therefore of more value as a specific character than any peculiarity not so adapted. In it the antler descends almost parallel to and close above the front, reaching down as far as the muzzle, there turning upwards in an abrupt, nearly straight line; the whole antler forming an elongated triangle, of which the apex is next the root of the horn. In the Lapland species the brow antler projects more directly out from the forehead, not being parallel to the front, but at a somewhat acute angle from it, and it is not formed in the triangular shape of the other, but, although palmated, has the ends curved up, as in the upper prongs or antlers (see fig. 2). Now, as

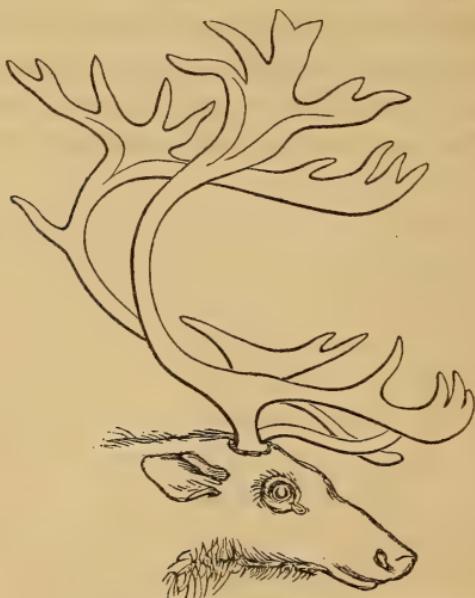


Fig. 2. (Lapland Species.)

already said, this character has more significance than the mere difference in form implies. We know that the deer with palmated horns are confined to the colder regions of the earth, and when the palmation is much developed it is probable that its purpose is to scrape and shovel away the snow from their food. But we see that all the deer with palmated horns are not equally provided with these shovels. Some are better and some worse; but none of them

bears any comparison with the apparatus of the North American Barren Ground caribou. It has, in addition to the basal palmated triangular shovel, a second projecting prong with terminal points or fingers curved inwards, very like the brow antler of the Lapland deer. The use of these pieces of apparatus is sufficiently obvious. The upper projecting antler with curved points is to scrape into and break the surface of the hard crust of frozen snow; the triangular ploughshare or spade is to shovel away the softer snow below; and its structure is so admirably adapted for this purpose, that it is impossible to doubt the evidence of design exhibited in it. In the more perfect specimens the two projecting basal prongs fill up the whole space above the head, and the termination of the right prong is slightly curved towards the right, like a shovel, or an open hand looking in that direction, and the other is slightly curved in the opposite direction; so that, actually, we have a double-acted shovel, no motion being lost—the reverse motion to the left, which was necessary to enable it to give the impetus of a fresh sweep to the right, clearing away in its course a shovelful to the left, and the returning motion to the right to give impetus to the motion to the left, shovelling away in its course a portion to the right. The less furnished specimens have only one single basal antler, but its straight upright position renders it nearly equally available for this double-acted power.

The habits of this species also are known to correspond with this structure. Every author who treats of the North American species speaks of its using its horns to clear away the snow; and whether this was recorded or not, the well-used and much-worn state of the palmated divisions in the specimens now received proves sufficiently that this is their habit, and, by inference, that this is the purpose for which the peculiar form which these horns possess has been bestowed upon them. That the Lapland deer also use their horns, more or less, in removing the snow from the food which it covers, may be true; but that their horns are much less used for this purpose appears, not only from the form of the horns, but also from the notices of their habits, which we find in the works of those authors who have treated of them. In some of

these a trivial notice occurs of their using their horns as well as their feet (which are their principal implements), but in most of them the feet are mentioned alone as used for this purpose, and no notice taken of the horns; so much so, that Colonel Smith says, in continuation of the passage already quoted,—“With them (the horns) they (the North American species) are also said to remove the snow, but it does not appear that this process has been noticed in Lapland.” This flat triangular blade, therefore, which is the proper and full-grown form of horn in the adult animal, and thus the normal and specific form, I consider to be one of the principal characters of the North American species.

It may, however, be said that this habit, and corresponding apparatus, in the American rein-deer, are mere variations induced by climate, and not specific distinctions. But it humbly appears to me that this character cannot be so treated. That a species inhabiting a colder and more barren district should degenerate in size may be admitted; and we should not, on account of its smaller size, think of making it anything more than a climatal variety; but that an animal should be provided with a different or a more developed apparatus in order to accommodate it to a different condition of life, seems to imply much more than such a variety. If the North American Barren Ground animal is provided with this triangular spade or shovel because the snow is deeper in America than in Lapland, and a more efficient implement is necessary to enable it to get at its food, I look upon this as being in itself proof of the distinctness of the species. If, on the other hand, the snow is not deeper in America than in Lapland, then the difference in the apparatus makes still more against the climatal theory; for here we would have a different form for the same conditions of life.

There are other differences besides those of the horns. The colour of the North American species is lighter, both in its summer and its winter garb—being yellowish-brown or fawn-coloured, instead of dark-brown, in summer, and white, instead of grey, in winter—matters which *per se* are not of much consequence, but which, taken along with other differences, are of some weight.

Another most important point is, that the North American species has never been domesticated; but this involves a question much too long and too important to be fully discussed in the present communication. My own view of it is, that those social animals which are capable of being thoroughly domesticated are invariably found domesticated, and that the fact of an animal not being *domesticated* is proof that it is not *domesticable*. It may be said that it is the fault of the Esquimaux that the North American species are not domesticated, that they are a less intelligent race than the Laplanders, or that they have less aptitude for domesticating animals. But this is not the case. They have domesticated their Esquimaux dogs; and that they have tried to domesticate the rein-deer, and failed, is, I think, to be inferred from the following remark of Hearne:—"The moose is the easiest to tame and domesticate of any of the deer kind;" implying that the attempt had been made upon them all; and as we know from other sources, that the moose and other deer have been tamed, but never domesticated, the inference from this remark of Hearne's is, that if the North American species had been *domesticable*, they would have been domesticated by them. Mr Hutchins, indeed, speaking of the woodland caribou, says that several of the fawns had been brought up at the factories, and had become as *tame* as pet lambs; so have antelopes and deer of all kinds. But we must bear in mind that taming and domestication are two widely different things—a lion can be tamed, but not domesticated. Our common bull is domesticated, but often not tamed. The taming of a wild animal must thus not be confounded with the domestication of a social animal, and does not bear upon the point in question. Indeed, I firmly believe that this is not a matter which is left by nature to chance. How it is managed I do not pretend to say—possibly by an imperious instinctive desire impressed on the animal, craving that it should be domesticated, and compelling it to make the first advances; but whatever be the mode, I entertain no doubt that the securing the object has been carefully attended to by nature from the first; and where an animal is *domesticable*, there is as little chance of its being found

undomesticated as there is of an undomesticable animal being found domesticated. The adoption of this (its domestication) as a specific character, would relieve our comparative anatomists and systematists from the inconsistencies and difficulties in which they have become involved in their attempts to determine the wild stocks from which our domesticated breeds have originally sprung. All inquiries on this subject have hitherto proceeded on the foregone conclusion that the domestic breeds must be referable to one or other of the wild species. Let this view be abandoned, and let it be conceded that it is at least possible that domesticable species have been created for the special use of man, and let the species, then, be compared with one another with as great a willingness to find them distinct as there hitherto has been a determination to find them the same, and I am sure that (in some of them at least) as good specific characters will be found for distinction as are thought sufficient in other species; and it must be kept in mind, that we are left, in considering the subject, almost entirely, if not wholly, to the *characters* of the animals themselves; for no instance occurs in which the actual period or process of domestication of any species has taken place under the eyes of man, or even has occurred within the period of authentic history. Neither can we point to any undisputed instance of a species having been once domesticated, and having afterwards relapsed into wildness. The African elephant, which we know from history was used, both in peace and war, by the Carthaginians and other North African nations in the time of the Romans, may be cited as an instance contradictory of this; but, in the first place, we do not know that the species possessed by the Carthaginians was the same species as that now found to the north of the equator in Africa, nor even that the species so found now is the same as the South African species. The effigies of some of the elephants represented on ancient Roman medals are no doubt figured with the large ears of the present South African species; but there may have been, and may still be, more than one species with large ears; and, in the second place, it is possible that there may be some species (among which the African elephant should possibly fall) which are only half domesticable,—such, perhaps, as our com-

mon duck (which has always a disposition to wander), the alpaco, &c., and which may not fall properly under the definition of domesticable animals, but rather form the link between those which are wholly so, and those which are not so at all. At the same time, I confess I prefer the undiluted theory, and hope at some future period to submit to the reader a more detailed explanation of my views and arguments on the subject.

Before leaving the horns, there is a statement made with regard to them by most authors which appears to me to call for revision, and regarding which I shall hope to get some of my new Hudson's Bay friends to make fresh observations. The statement is, that the male sheds his horns in November. Now, it appears to me so opposed to all the usual proceedings of nature that she should provide this admirable apparatus for clearing away the snow, only to throw it off at the very period when it would come into use, that I cannot bring myself to believe that there is not some error in the statement. I have therefore examined as many authorities as I could, in order to trace from whence this statement originated ; for we often find in Natural History, that a statement originated by some one individual is repeated by subsequent writers without inquiry or consideration. The oldest statement on the subject which I find is that of Pennant in his "Arctic Zoology,"* where he says, "They go to rut in September, and the males *soon after* shed their horns." Hearne, who had ample opportunity of judging from personal observation, makes the following remarks in his journey to the Northern Ocean, 1795 :†—"The month of October is the rutting season with the deer in these parts, and after the time of the courtship is over, the bucks separate from the does : the former proceed to the westward to take shelter in the woods during the winter, and the latter keep out in the barren ground the whole year. This, though a general rule, is not without some exceptions, for I have frequently seen many does in the woods, though they bore no proportion to the number of bucks. This rule, therefore, only stands good respecting the deer to the north of Churchhill River ; for the deer

to the southward live promiscuously among the woods, as well as in the plains, and along the banks of rivers, lakes, &c., the whole year. The old buck-horns are very large, with many branches, and always drop off in the month of November, which is about the time they begin to approach the woods. This is undoubtedly wisely ordered by Providence, the better to enable them to escape from their enemies through the woods, otherwise they would become an easy prey to wolves and other beasts, and be liable to get entangled among the trees, even in ranging about in search of food. The same opinion may probably be admitted of the southern deer, which always reside among the woods, but the northern deer, though by far the smallest in this country, have much the largest horns, and the branches are so long, and at the same time spread so wide, as to make them more liable to be entangled among the underwoods than any other species of deer that I have noticed. The young bucks in those parts do not shed their horns so soon as the old ones. I have frequently seen them killed at or near Christmas, and could discover no appearance of their horns being loose. The does do not shed their horns till the summer, so that when the buck's horns are ready to drop off, the horns of the does are all hairy, and scarcely come to their full growth." This certainly is the testimony of a man apparently conscientious and desirous to tell the truth, with no object to do otherwise, and, moreover, with ample opportunity of getting at the truth, and with his attention specially directed to the subject, all which of course make the matter only more embarrassing. Next comes Colonel Smith : " *The males drop their horns after the rutting season in November*, but the females, if gravid, keep theirs till May; under other circumstances, they drop theirs at the same time with the males; the new ones are eight months growing, not being complete till August." The anomaly to which I am alluding appears, however, to have struck him as well as Hearn, for he offers the following explanation of the rein-deer shedding its horns so early as November:—" The horns of the rein-deer, indeed, drop in winter, but this takes place only at a period when the snow is already not only very deep, but frozen hard, and even then we see that the females, when gravid, and therefore in

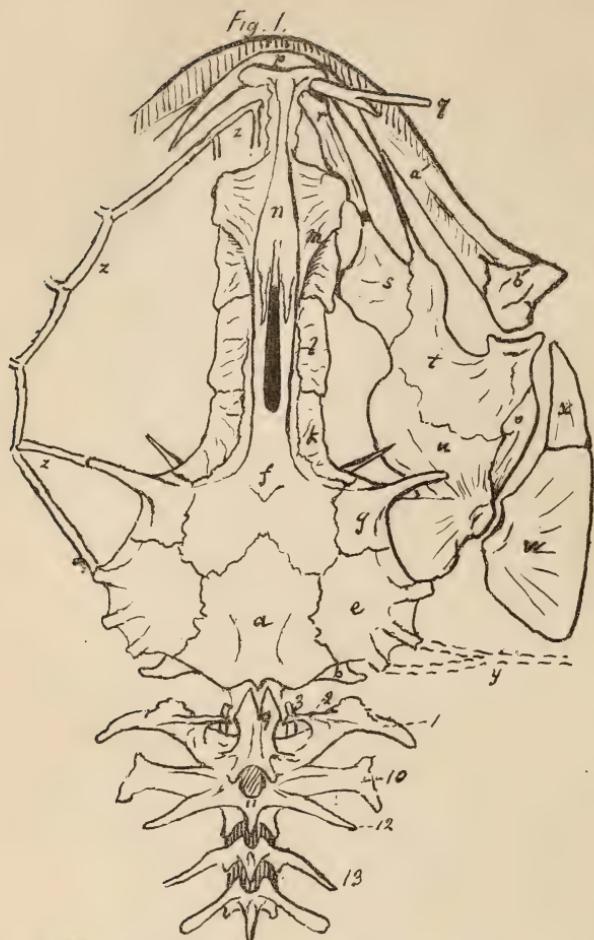
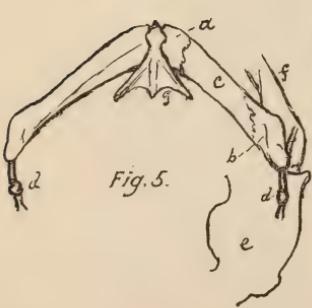
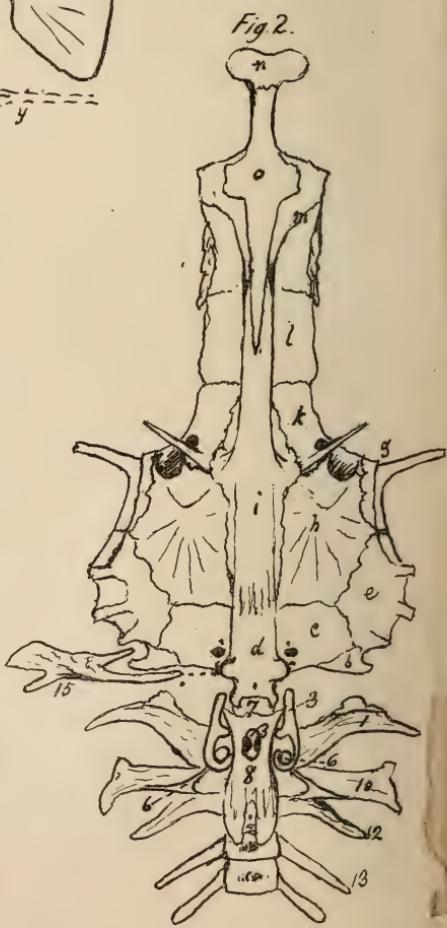


Fig. 2.



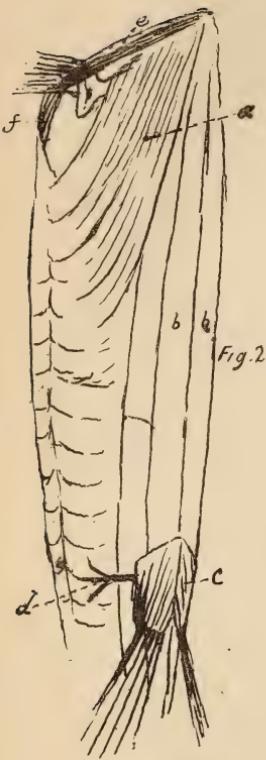


Fig. 2.



Fig. 5



Fig. 3.



Fig. 4.



Fig. 1.

want of a greater supply of food, preserve theirs till May.”* Of the two, I must say I prefer Hearne’s reason for the horns dropping in November. The harder frozen the snow, the more need of good implements to get at their food, which is under it; and if it is necessary for the females getting their food that they should retain their horns through the winter, the additional claim arising from their bearing an embryo or a foetus scarcely seems sufficient to account for their having the means of securing it, while the males have not. Another, and not the least formidable testimony, is that of Sir John Richardson.† He says—“This (the velvety covering of the horns peeling off) takes place in September, previous to the commencement of the rutting season, *and by the end of November most of the old bucks have shed their horns.* The young males retain theirs much longer, and the females do not lose their horns until they are about to drop their young, in the month of May.” Now, Sir John had a good opportunity of ascertaining how the fact stood; but I do not wholly read the paragraph I have quoted as a statement depending upon his own personal observation, for he goes on—“Hearne observes that the Barren Ground caribou bears horns twice the size of those of the woodland variety, notwithstanding that the latter was a much larger animal;”—thus showing that at the very time he wrote the paragraph he had been consulting Hearne, and it is just possible that it is his (Hearne’s) observation that he is repeating, instead of giving the results of his own. His statement of the movements of the rein-deer is more important, and it corresponds more with Hearne’s view of the reason why the horns are shed in November. He says‡—“The Barren Ground caribou, which resort to the coast of the Arctic Sea in summer, retire in winter to the woods lying between the sixty-third and sixty-sixth degree of latitude, where they feed on the *Usneæ*, *Alectoriae*, and other lichens which hang from the trees, and on the long grass of the swamps. About the end of April, when the partial melting of the snow has softened the *Cetrariae*, *Corniculariæ*, and

* Griffith’s Cuvier’s Animal Kingdom, vol. iv., p. 70.

† Fauna Bor. Am. i., p. 241.

‡ Loc. cit., p. 242.

Cenomyces, which clothe the Barren Grounds like a carpet, they make short excursions from the woods, but return to them when the weather is frosty. In May the females proceed to the sea-coast, and towards the end of June the males are in full march in the same direction. At that period the power of the sun has dried up the lichens on the Barren Grounds, and the caribou frequent the moist pastures which cover the bottoms of the narrow valleys on the coasts and islands of the Arctic Sea, where they graze on the sprouting carices and on the withered grass or hay of the preceding year, which is at that period still standing and retaining part of its sap. Their spring journey is performed partly on the snow, and partly, after the snow has disappeared, on the ice covering the rivers and lakes, which have in general a northerly direction. Soon after their arrival on the coast the females drop their young; they commence their return to the south in September, and reach the vicinity of the woods towards the end of October, where they are joined by the males. This journey takes place after the snow has fallen, and they scrape it away with their feet to procure the lichens, which are then tender and pulpy, being preserved moist and unfrozen by the heat still remaining in the earth." "The lichens on which the caribou principally feed whilst on the Barren Grounds, are the *Cornicularia tristis*, *divergens*, and *ochroleuca*, the *Cetraria nivalis*, *cucullata*, and *islandica*, and the *Cenomyce rangiferina*,"*—all low ground-growing species. The statements, however, of the latest observer on the subject, Dr Armstrong†, are somewhat different, both as regards the shedding of the horns and the migration of the deer. As to the first, he says, "The calving season, as far as my observation enables me to judge, is in June, prior to, and coeval with which the bucks shed their antlers, which appear to be again entirely reproduced in the latter end of August and early in September;" and elsewhere he especially notices the rapidity of growth of the new horns. As regards the second part, he makes the following remarks; and observations to the same effect occur in "Osborn's Voyage of the Investigator":—"It has hitherto

* Loc. cit., p. 243.

† Personal Narrative of the Discovery of the North-west Passage, 1857.

to been the generally received opinion that these animals migrate to the southward, on the approach of winter, to lands where the cold is less intense and the pasturage more abundant, an opinion formed from the writings of distinguished Polar voyagers who formerly wintered amid the icy solitudes of the North ; but the experience of four winters enables me to speak from the result of observations in contradistinction to this. In the Prince of Wales' Strait rein-deer were seen in January—our distant position from the shore not enabling us to hunt during the winter; and in the Bay of Mercy, for two successive winters, they were constant inhabitants of the land, and were killed throughout the winter months of the coldest season in the records of arctic voyaging. How far the migratory habits of the animal may be established in a more southern latitude on the coast of America, in their instinctive resort to localities where pasturage may be more abundant, I shall not attempt to decide ; but this I will say, that from the more distant lands of the Polar Sea they do not migrate on the approach of winter, but remain there constant inhabitants. I have remarked, however, that as the season of thaw sets in (May and June), coeval with the calving of the does, these generally resort to the ravines and valleys bordering the coast, where the pasturage is so much more abundant.”*

These narratives of the habits and food of the animal at different periods, and in different regions, are sufficiently discordant to induce us to pause before coming to an opinion upon them. They show the necessity of further observations, and indicate the points to which attention should be directed. Their tendency, on the whole, however, is in favour of what appears to me the necessary inference to be drawn from the horns. To the statements of the foregoing authors, where opposed to this view, I reply by pointing to the horns themselves. Not only is the ploughshare there, but it is evident it has been much and hard used; the edges are all rubbed off, and the inequalities smoothed down ; and it is plain that this cannot have been done by removing snow in the summer-time, when it is all melted. From the specimens I have received I draw the

* *Loc. cit.*, p. 276.

following inferences :—*1st*, That they are the heads of old bucks : the size of the horns and worn teeth prove this ; *2d*, That the triangular palmated plates on their horns are formed and used for the purpose of shovelling away the snow to get at their food ; *3d*, That they have been used for this. *4th*, That they have been so used for a longer period than the month or six weeks after snow has fallen (in September and October) which Sir John Richardson gives them for returning over the Barren Grounds, where the lichens grow which they disinter for their food ; *5th*, That it is in the winter they have been so rubbed and worn, and not in the summer ; and, *lastly*, It should follow from these premises that the horns are not shed in November. Another argument against their being shed then may be drawn from what takes place with other deer. The red deer, for instance, in this country has its rutting season in September (the same time as the rein-deer), and the horns are not shed till April or May—the oldest, however, shedding them first. It is to be kept in mind that the rutting season and the growth of the horns are intimately connected together, the reproducing power under which the new horns advance in growth being then exerted to the utmost. The other North American deer, like the red deer and other stags, do not shed their horns before winter. The moose keeps them the whole winter ; and the instance in question, if true, seems to be a solitary exception to the economy of all the rest of the deer tribe, so far as I have been able to ascertain. Still, the statements on the subject are too explicit, and from too high authority, to be evaded by an argument or an inference ; although I must say that it is long since I have been of opinion that circumstantial evidence is of ten times more value than the best direct testimony in the world. All that I mean, therefore, by making these remarks, is to invite the attention of those who may have the opportunity of observing the animals to a more careful examination of the economy of the old bucks in respect to the shedding of their horns.

The two smaller heads sent me by Mr Hargrave as exceptional, from the form of their horns, are interesting. The one, from the state of its worn teeth, is obviously an old deer, although small in size, and with small horns. Its horns

have, however, met with a distortion by which they have a curious bend in the middle, as shown in this figure. The



Fig. 3.

cause, whatever it may have been, has affected them both equally, which is not usually the case where horns are distorted—it generally happening that if one horn is injured so that it takes reduced dimensions, the nourishment which was meant for it is diverted to the other horn ; and we have the two horns characterized, one by defect, and the other by excess. It is not easy to say what may have been the cause of this curious distortion. It may be that the poor animal, when its horns were still soft and young, got entangled among brush-wood ; and that here is the silent evidence of long struggles on the part of the animal, and of perhaps days of famine, before it succeeded in freeing itself from the bonds which held it. Or it may merely be a distortion consequent upon the old age of the animal, for we often find the horns in old deer stunted and distorted, although it is not usual to find them so symmetrically disfigured. It will be observed that this head wants the triangular ploughshare in front, but as it is obviously an abnormal and exceptional head, this want goes for nothing in the question of species. One of the other heads sent by Mr Hargrave is a young one, as shown by the teeth, and has not yet got the fan-shaped ploughshare, which, like other antlers, only appears after the animal has acquired a certain age. It is unnecessary, moreover, to say, that in the observations I have previously made as to the form of the horns

in the different species, I have spoken of characteristic examples of the full-grown animal, not of young or exceptional horns.

The dentition in the young deer is deserving of notice. The incisors overlap one another in a curious manner, except the outermost, which fits into a groove on the edge of the penultimate tooth. In the older heads the teeth stand apart. They are all very small; and the mode in which they are worn away in the older animals is peculiar. Instead of being worn flat on the crown, or somewhat inwards, as is the case with other ruminant animals, the front of the central teeth are worn down obliquely outwards. This arises most certainly, not from nipping *Usneas* hanging from the trees, or from cropping grass like a sheep, but from grubbing up the *Cenomyces* and other lichens growing flat on the surface of the ground—an additional argument in favour of these being their principal food.

Another interesting structure in these animals remains to be noticed; I mean the fur or hair. Of this Sir John Richardson says—"In the month of July the caribou sheds its winter covering, and acquires a short smooth coat of hair of a colour composed of clove brown, mingled with deep reddish and yellowish browns; the under surface of the neck, the belly, and the inner sides of the extremities remaining white in all seasons. The hair at first is fine and flexible, but as it lengthens it increases gradually in diameter at its roots, becoming at the same time white, soft, and compressible, and brittle, like the hair of the moose deer. In the course of the winter the thickness of the hairs at their roots becomes so great that they are exceedingly close, and no longer lie down smoothly, but stand erect; and they are then so soft below that the flexible coloured points are easily rubbed off, and the fur appears white, especially on the flanks. The closeness of the hair of the caribou, and the lightness of its skin when properly dressed, renders it the most appropriate article for winter clothing in the high latitudes. The skins of the young deer make the best dresses, and they should be killed for that purpose in the months of August or September, as after the latter date the hair becomes too long and brittle. The prime parts of eight or ten skins make a complete suit of

clothing for a grown person, which is so impervious to the cold, that with the addition of a blanket of the same material, any one so clothed may bivouac on the snow with safety, and even with comfort, in the most intense cold of an arctic winter's night."*

On a close examination of the skin, I have not found anything particularly different from the skin of any other animal. The hair is more patent to examination, and is interesting, not only in relation to its own economy, but also in relation to the views held by histologists of the structure of hair in general, and by physiologists of its mode of growth and development. It has already been made known by Professor Busk, that the hair of the deer tribe is peculiar, being almost entirely cellular; and the hair has been described and figured by Dr Inman, in an able paper "On the Natural History and Microscopic Character of Hair," published in the "Proceedings of the Literary and Philosophical Society of Liverpool," No. 7 (1851 to 1853); but as my observation somewhat differs from his, and he has limited his figure to what appears to me an inaccurate representation of the larger hair in one aspect, and has not described the equally interesting finer and smaller hairs, I have thought it desirable to give a careful view of both, with magnified representations of different sections; and that there may be no exception taken to their accuracy, I have got the drawing made by Dr Greville, whose name is a sufficient guarantee for its fidelity. The subject figured is the skin and hairs of one of the above-mentioned North American rein-deer; but the structure seems to be the same in all deer—at least it is so in all which I have examined—in the moose in the red-deer, roe-deer, musk-deer, &c., but not in the antelopes.

The figure on the right hand represents a somewhat magnified portion of the skin, with both kinds of hair issuing from it; the left hand figure represents a more highly magnified small hair; the upper centre figure shows a highly magnified portion of the large hair; the lower centre figure a transverse section of this; and the middle centre a longitudinal section.

* *Loc. cit.*, p. 242.

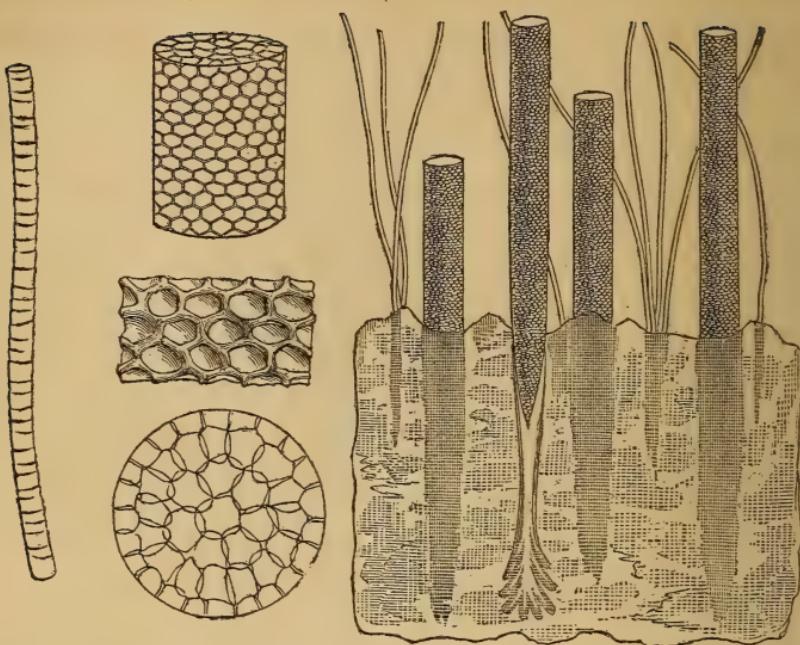


Fig. 4.

Dr Inman says:—"In the deer the cells are so numerous as to occupy the whole of the body of the hair, and so irregular that no particular place of subdivision can be traced;" and his figure quite corresponds with this, the cells being there shown as amorphous; but it will be seen from the above figure that they are truly polygonal—for the most part hexagonal, and there are very distinct septa and lines of separation. In fact, as Dr Greville pointed out to me, one of the most striking points in this structure is its close resemblance to (I might almost say identity with) polygonal cellular tissue seen in the hairs and other parts of plants.

The difference between the long and thick hairs, and the fine small hairs, is interesting and suggestive. We have here types of the two great sections into which hair may be divided growing side by side; the one wholly cellular, the other apparently without cells at all, and wholly horny and cortical. I do not doubt that, by the use of proper agents, we would find that the latter has a central cellular medulla or pith, as in the

* Loc. cit., p. 89.

human and other hairs of a similar appearance. Like them, and most other hairs of that texture also, these fine hairs are imbricated, as may be faintly seen in the woodcut.

It is held by physiologists that both these kinds of hair are modelled on the same plan, viz., that of a cellular interior, surrounded by a horny cortical exterior, and that the difference in texture arises from the difference in the extent of development of the internal cellular pith or of the external cortical covering. In the one extreme forming the soft hair of the deer; in the other, the hard bristle of the sow. This view recommends itself by its simplicity and the unity of the *modus operandi*; but although it may be correct, so far as it goes, it does not explain the whole of the phenomena. For example, it does not explain why the hairs, where the horny covering predominates, are imbricated, while those which are cellular are not; and it is to be observed, that there is a want of transition between the two characters of hair which certainly is opposed to a common mode of development. If it were the same, we ought to find hairs exhibiting all the gradations of passage between the two extremes, which we do not. Furthermore, they appeared to be designed for different purposes. Speaking in a general way, the horny or bristly hair is characteristic either of carnivorous animals, who have a greater supply of caloric than vegetable feeders, or of graminivorous animals inhabiting warm climates; while the cellular hairs in question are confined to the deer tribe, most of whom inhabit cold climates. It has usually been said, that the fine hair found at the roots of the coarser hair in these animals is an additional provision of nature for the warmth of the animal. It rather appears to me that in the deer at least it is the larger cellular hairs which have been added for this purpose (no one can look at them, I think, without seeing how admirably they are adapted for this), and that the horny hairs, whose office may possibly be as much that of a regulator of temperature as of a heating apparatus, are the normal hairs of the animal reduced to the smallest dimensions. If these two kinds of hair have distinct functions, their mode of development may also possess distinctive characters. We see that their roots extend to very different depths in the skin, and although we know that the hair is a mere appendage of the skin, pro-

duced by its involution or evolution, it may be that, by drawing more of its substance from one layer than from another, the differences in its appearance, which we have been considering, are produced. These are points on which the recent researches of Kölliker, Leydig, Queckett, Inman, and other microscopists have not touched. It is only a skilful histologist who can take them up with any chance of success ; and as I have no pretensions to such a title, I am glad to have enlisted my friend Dr Turner (Demonstrator of Anatomy) in the examination of the subject, and he has undertaken to see if he can throw any further light upon it.

Another interesting provision with regard to the hair is, that in the rein-deer and the moose or elk (the only two arctic species or families) the part of the muzzle called the muffle, instead of being left bare and moist, as in other ruminants, is clothed with hair—this forming the generic character of the group. A moment's consideration of what the effect would be of plunging a bare and moist muzzle into frozen snow, in the search after lichens, will show how necessary a deviation this is from the normal structure of that part. At first sight one might expect, on like grounds, some analogous deviation from the normal condition of the stomach in arctic animals, but there is none such, and the reason probably is that that organ is not very sensitive, and any special protection to it against the coldness of the food is therefore unnecessary.

The skin appears to be a good deal cut up before winter by the gad-flies and *Œstri*, and we have no account how the damage done by these creatures is repaired before the severity of the winter begins to be felt ; doubtless, the sores quickly heal as soon as the originators of the mischief drop out, and the part will only be thicker on account of the healing process ; so that it would be rather curious if the unattacked part of the skin turned out to be in reality the weakest. The hair, too, is cast and replaced at this time, so that the comfort of the animals is sufficiently provided for.

III. (1.) *On Reproduction by Ova from the Medusoid of Campanularia Johnstoni.* (2.) *On Ephelota coronata, a new Protozoan animalcule.*
By T. STRETHILL WRIGHT, M.D.

1. *Campanularia Johnstoni.*

Campanularia Johnstoni occurs commonly at low-water, on the shores of the Firth of Forth, and is doubtless very familiar to many of the members of this Society.

At all seasons of the year it produces campanulate medusoids (Plate XIX., fig. 3), each having four tentacles capable of great extension, four intermediate rudimentary tentacles and eight auditory organs, consisting of sacs, each containing a single spherical crystal of carbonate of lime, and situated one on each side of each of the rudimentary tentacles.

The medusoids are produced within coarsely-annulated capsules, developed generally from the creeping fibre which unites the polyp-stems; but sometimes also from the polyp-stem itself, in which case the stem is generally branched, and the capsule axillary. The capsule is traversed by a fleshy axis, dilated at its summit. From this axis, which may be considered as a reproductive polyp, homologous with the reproductive polyp of *Hydractinia*, the medusæ pullulate, inclosed within sacs formed by a layer of ectoderm derived from the fleshy axis of the capsule. The tissues of the medusoid are developed from, and continuous with, both the layers (endoderm and ectoderm) of the axis, and are at first a mere diverticulum thereof, as I have described to the Society in the case of the medusoid of *Eudendrium*.

The medusoid of *C. Johnstoni* was described by the Rev. T. Hincks in August 1852, and again by Mr Gosse in 1853, neither of which gentlemen detected in it any ovaries, though Mr Gosse has figured enlargements on the lateral canals (fig. 3, α), where those organs exist.

In spring last, I obtained a large number of these medusoids from a specimen of *Campanularia Johnstoni* in my possession; and on examining some of them directly after their escape from the capsule, I was surprised to find that the enlargements figured by Gosse contained ova (fig. 4), with the

germinal vesicle clearly distinct, under a power of 600 diameters.

I placed a number of the medusoids in a flat and deep glass saucer of pure sea-water, and in about a week young Campanularias were found attached to the bottom of the saucer, each of which consisted of two polyp-stalks, united by a creeping fibre.

The various stages of development in the ova were not observed, on account of their extreme minuteness.

In confirmation of these observations, Mr Alder writes me, in answer to my statement of the fact above mentioned to him, that Mr Hincks made similar observations at the Isle of Man, in autumn last. And further, my friend Mr Dallas, Edinburgh, informs me, that he also observed a number of young produced in a vessel containing *Campanularia Johnstoni* in spring last.

2. *Ephelota coronata*. (Mihi).

In the seventh volume of the "Annals of Natural History" (1851), Mr Alder has described three new animals, belonging to the Protozoa, two of which are marine, and found parasitic on Sertularia, while the third is an inhabitant of fresh water, and a parasite on Paludicella. Mr Alder gave no names to these animals. It therefore fell to Mr Pritchard (who, in his work on the Infusoria, has included them in the family Enchelia) to invent a name for them. Mr Pritchard chose the designation *Alderia*, and specified the animals as *apiculosa*, *ovata*, and *pyriformis*. "Alderia" had, however, been previously appropriated to one of the nudibranchiate Mollusca, so that the animals still remain without generic names. On carefully reading Mr Alder's descriptions, and comparing them with the descriptions and figures given by Ehrenberg of *Podophrya fixa* and *Acineta Lyngbyei*, I have concluded that Mr Alder's animals should be placed in two genera; that Pritchard's two species, *ovata* and *pyriformis* (the tentacles of which are slender and capitate, or knobbed) belong, together with *Acineta Lyngbyei*, to the genus *Podophrya*; whilst *apiculosa* (the tentacles of which are pointed) must be referred

to a new genus, for which I propose the name *Ephelota* (from *επι* and *ηλος*, a peg, and its derivative adjective *ηλωτος*).

The body of *Ephelota apiculosa* (Alder's first described animal) is cup-shaped, set round with numerous pointed tentacles, abruptly thickened towards the base, and forming more than one row. They have very little motion, but are occasionally bent forwards, and sometimes slowly retracted. Body attached to a stout stem. In Mr Alder's figure the stem appears of the same thickness throughout. I have occasionally found an animal, which I believe to be identical with *Ephelota apiculosa*, growing on *Coryne*. It differs from *Ephelota coronata* (the animal I have figured, Plate XVIII., fig. 1), in having the body more cup-shaped, elongated, and wider than the stem ; the tentacles more irregular, soft, retractile, and unsupported by the solid matter which occurs in the interior of those of *Ephelota coronata* ; and, especially, in the shape and structure of the stem, which is nearly of equal diameter throughout, and consists of a *medullary substance*, the fibres of which pass in a longitudinal direction, inclosed within a *cortical substance*, formed of circular fibres, passing at right angles to the fibres of the medulla—which cortical fibres are absent in the stem of *Ephelota coronata*.

I have found *Ephelota coronata* only twice, each time in large colonies, situated within the mouth of shells inhabited by the hermit crab, where the dense white bodies of the animalcules, seated on their transparent pedicles, form sufficiently remarkable objects.

The body consists of a short cylinder of densely granular sarcod, slightly enlarged above and below, so as to resemble the circlet of a crown. It is surmounted by a circle of thick, acuminate, and radiating tentacles, which are capable of being slowly curved inward, but cannot be contracted. They remain stiffly extended, even when the animal is immersed in alcohol. The structure of the tentacles is, I believe, unique. Under high microscopic power, they are each seen to consist of a bundle or frame-work of fine parallel rods of horny (?) texture, embedded in soft contractile sarcod. The more central rods of the bundle (as in the figure 2) protrude continually beyond those exterior to them, so that the point of the tentacle is

formed of only a very small number. In the animals of the second colony—under a power of 800 diameters—each rod assumed a beaded structure (fig. 2), which I had not before observed.

The animal secretes beneath itself, or from its base, a pedicle of diaphanous and colourless substance, which increases in length and breadth with the increasing growth of the animal, until it assumes the form of a long glassy club, on the thick upper extremity of which the animal is seated. The whole of the pedicle is covered by a growth of scattered hairs, but it may be doubted whether these have any organic connection with it, and whether they do not belong to one of those minute classes of *Algæ*, the structure of which eludes microscopic research. A longitudinal fibrous structure is faintly seen in the axis of the pedicle, but it gradually disappears towards the periphery. After immersion in spirit, this fibrous structure becomes much more apparent. The action of the spirit, also, causes a fine membrane to separate from the surface of the pedicle, which appears to be continued downwards from the body of the animal, and is probably analogous to the membrane which I have already shown to exist as a lining and covering to the cell of *Vagincola valvata*, and which secretes and hides within itself the valve that closes the cell of that curious animal.

Dr WRIGHT also exhibited living specimens of the new *Laomedea acuminata* (Alder), with its medusoids.

Several specimens of the Clouded Saffron Butterfly, *Colias edusa* (including two females), taken in the county of Dumfries, were exhibited by Mr W. STEWART THORBURN; a visitor for the evening. This insect has hitherto been very rarely met with in Scotland.

Wednesday, 23d December 1857.—Professor BALFOUR, President, in
the Chair.

The following gentlemen were elected the Office-Bearers for the Session 1857-8:—

Presidents.—J. H. Balfour, M.D., Professor of Botany, University of Edinburgh; Andrew Murray, Esq., W.S.; William Rhind, Esq.

Council.—M. Forster Haddle, M.D.; Robert Chambers, Esq.; Thomas

Strethill Wright, M.D.; W. H. Lowe, M.D.; Alexander Rose, Esq.; George Logan, Esq., W.S.

Secretary.—John Alexander Smith, M.D.

Assistant Secretary.—George Lawson, Ph.D.

Treasurer.—William Oliphant, Esq.

Honorary Librarian.—Robert F. Logan, Esq.

Library Committee.—John L. Stewart, Esq.; Alexander Bryson, Esq.; Patrick Dalmahoy, Esq., W.S.

James M'Bain, M.D., R.N., formerly a Non-Resident Member, was admitted a Member of the Society.

The following donations to the Library were laid on the Table, and thanks voted to the donors:—

1.—Resumen de los Trabajos Meteorologicos, 1854, verificados en el Real Observatorio de Madrid bajo la Direccion de Don Manuel Rico y Sinobas. From Don Manuel Rico y Sinobas. 2.—Ophthalmic Hospital Reports, and Journal of the Royal London Ophthalmic Hospital, No. I., 1857. Edited by J. F. Streatfeild. From the Editor.

The following communications were read:—

I. *On the Skull of a Wombat (Phascolomys) from the Bone Caves of Australia, with a few general remarks on the Marsupiata.* (The cranium was exhibited.) By JAMES M'BAIN, M.D., R.N.

After some preliminary remarks upon the first discovery of marsupial animals—the opossums in America, and afterwards the kangaroos in Australia, during the first voyage of Captain Cook—it was stated that upwards of seventy species have already been found on the Australian continent. That recent species also inhabit Tasmania, New Zealand, and several islands of the Indian seas. Fossil remains have been discovered in the Stonefield slates, near Oxford, belonging to the Lias formation. One species of *Didelphis (D. Cuvierii)* in the Montmartre gypsum, near Paris, and at least five genera from the bone caves of Wellington Valley in Australia, have been found in a fossil condition. A brief review of the classification was gone over, and the grounds upon which the various classifications were based. That of Profesor Owen is founded on the teeth, stomach, and the presence or absence of an *intestinum cæcum*, in reference to the food of these animals. The characteristic term *marsupial*, applied to this group of *mammalia*, is derived from two bones situated on the

pubic bones of the pelvic arch, affording support for a marsupium or pouch in the female, into which the ooviviparous offspring is received at its birth. With the exception of the *Thylacinus cynocephalus*, or pouched dog-headed Thylacine of Tasmania, these marsupial bones have been found to be present in both sexes in all the animals of this group yet examined.

After these and other general remarks on some of the leading points connected with the marsupial group of mammals, Dr M'Bain gave a detailed description of a skull in his possession.

" This skull was presented to me by an esteemed friend and worthy member of the Royal Physical Society, Dr M'Kay, R.N. It was given to Dr M'Kay by a lime-burner, who followed his vocation at the limestone cliffs which extend along the entrance of the Bay of Melbourne, in the colony of Victoria. The fossil remains of marsupial animals discovered in Australia have been chiefly obtained from the limestone caverns of Wellington Valley. Major, now Sir Thomas L. Mitchell, formed a considerable collection of these remains ; and they are described by Professor Owen in the second volume of a work entitled ' Three Expeditions into the Interior of Eastern Australia, by Major T. L. Mitchell, Surveyor-General. From the examination of these and other fossil mammalian remains, it would appear that they belong, for the most part, to genera still presenting living species in that country. Several, however, from their peculiarities of structure, form the types of new genera. One of these genera is *Phascolomys*, to which this skull belongs. So far as I have been able to ascertain, we have no skulls, recent or fossil, belonging to this genus in any of the public collections in Edinburgh. This has induced me to exhibit the present specimen to the Royal Physical Society, although the absence of crania from the public museums has precluded me from being able to determine whether this skull belonged to a recent or an extinct species.

The length of the skull, on its upper coronal surface, measured from the anterior tips of the nasal bones to the perpendicular crest of the occiput is $6\frac{7}{10}$ th inches. From the anterior margin of the frontal bone to the occipital crest, $3\frac{9}{10}$ th inches. Length of nasal bones, $2\frac{7}{5}$ th inches.

The greatest breadth from the upper edge of the zygomatic arch is $4\frac{8}{10}$ th inches. Breadth of nasal bones anteriorly $\frac{7}{10}$ ths of an inch. Breadth of nasal bones posteriorly $2\frac{2}{10}$ th inches. The distance apart between the two temporal ridges behind is $\frac{6}{10}$ ths of an inch. At the anterior part of the orbit, the distance between the lateral ridges, across the frontal bone, is $2\frac{1}{2}$ inches.

“ On the under surface or base of the skull, from the anterior extremities of the premaxillary bones to the foramen magnum, the measured length is $6\frac{1}{2}$ inches. Extending transversely from the posterior and outer edge of the malar bones, where they advance upon the glenoid cavity, the measured breadth is $5\frac{6}{10}$ th inches.

“ With regard to the composition of the cranium, the original elements constituting the four occipital segments of the skull present a flat, vertical surface, and are united by continuous ossification. This ankylosed condition also applies to other sutural connections; for instance, the sagittal and parieto-temporal, which generally remain open in marsupial crania, even in adult life. This is well seen in the kangaroo and koalo, in the Barcleian Museum of the Royal College of Surgeons, the only examples of marsupial crania in that valuable collection. In the koalo, the four occipital elements are quite distinct, and there is a well-developed suborbicular-shaped interparietal bone.

“ In the wombat, the interparietal appears to be represented by a slightly-raised curved ridge, between the posterior margins of the lateral temporal ridges, inclining a little downwards to join the supra-occipital.

“ The mastoid bones are wedge-shaped, and situated between the par-occipital, supra-occipital, and a flattened, inferior, angular prolongation of the posterior root of the zygomatic arch, having the tympanic bones situated in front.

“ The tympanic bone is about an inch in length, wedged between the par-occipital, mastoid, and inferior angular prolongation of the zygomatic root posteriorly, and inner portion of the glenoid articulating surface anteriorly. The squamosal element of the temporal bone is largely developed, but, from being ossified to the parietals, it cannot be distinctly traced. The zygomatic arch is long in respect to the entire length of

the skull. In this specimen it measures nearly 5 inches. The malar bone extends backwards as far as the articulating surface of the lower jaw, of which it forms the outer edge. In front, the malar becomes flattened from above downwards, until the upper and lower margins nearly join, thus forming a broad, concave space for the eye to rest upon. This peculiar form of zygoma bears an evident relation to the horizontal flattening of the upper and under surface of the skull, and greatly diminishes the resemblance which in many respects exist between the rodent order of placental mammals and the wombat.

"A narrow ridge, two inches in length, directed from within outwards, forwards and upwards, and slightly concave transversely, forms the articular surface for the lower jaw. This remarkable structure of the glenoid cavity permits of free movement in every direction, and in this peculiarity of mechanism it differs from the kangaroo and koalo amongst its congeners, and from the rodent order of placental quadrupeds. The palate bones are connected by a bridge in the line of the longitudinal palatine suture, and to the maxillaries by the transverse suture. This bridge, formed by the under surface of the crest of the palate bone, divides the two posterior palatine foramina, which, in the form of two elongated fissures, extend from the elevated posterior curved edge of the palate bones, giving origin to the muscle of the uvula, nearly to the maxillaries.

"Two smaller foramina are seen behind these in the under and back part of the nasal plate of the palate bone. The anterior palatine fissures or foramina incisiva, less in size, but similar in shape, are not entirely confined to the premaxillary bones, the anterior extremities of the palatine process of the maxillaries entering slightly into their formation. The sutural connections of the premaxillaries are well marked in this skull. They articulate largely with the nasal bones, but do not entirely separate the maxillaries from the nasal. There is a distinct, but very narrow process of the maxillary bones running between the malar and premaxillary, until it spreads out into a small, irregular quadrilateral-shaped bone in front of the lachrymal, like one of the so-called ossa wormiana.

“Professor Owen has directed attention to the fact, that with three exceptions (*Echidna*, *Ornithorhynchus*, and *Tarsipes*), all the species of marsupials had the angle of the lower jaw bent inwards, encroaching on the space between the two branches. That on looking down upon the margin of the jaw a more or less flattened surface is observed, extending between the external ridge and internal inflected angle. This character is strikingly manifested in the wombat. Instead of the usual vertical compressed form of this portion of the lower jaw, a strongly depressed horizontal form is observed, with deep hollow spaces for the insertion of the masseter muscles externally, and the internal pterygoids within, two muscles which, along with the external pterygoids inserted into the sigmoid notch before the condyles, and the temporal muscles surrounding the coronoid process, are those chiefly concerned with the movement of the jaws in the act of mastication. A large foramen is seen at the outside of the posterior mental foramina, probably for the transmission of nerves from the inferior maxillary branch of the fifth pair, to the largely developed masseters; which usually pass, along with the blood-vessels, over the sigmoid notch.” The characters afforded by the teeth were next briefly described:—“Two nearly straight incisors, three inches in length, occupy the narrow extremity of the lower jaw, extending directly backwards a little beyond the bifurcation; and two, deeply implanted in the premaxillaries, much curved and twisted, occupy the upper jaw.

“One single and four double molars, with flat triangular crowns deeply inserted in the alveoli, complete the dental formula. There is a marked difference in the position of the molars in the two jaws; whereas the curvature of the molar teeth in the lower jaw have their convexity turned outwards, it is exactly the reverse in the upper, so that when the jaws are closed the external triangular apex of the teeth in the lower jaw meet the broader external base of those in the upper. The teeth have no roots, and they are all more or less hollow at the base.

“From an examination of the figures in the second volume of the work of Sir Thomas L. Mitchell, and comparing Professor Owen’s description of the prismatic form of the teeth with those

in this specimen, I am led to infer that this skull either belongs to a recent species, or at least to a distinct one from the '*Phascolomys Mitchellii*.'

Before concluding, attention was drawn to what appears an interesting osteological investigation, and one in which many valuable characters might be found for fixing classification on a more strictly scientific basis; this was the general form, modification of structure, and more especially the position, of the foramina for the transmission of blood-vessels and nerves at the base of the skull. No part of the skeleton presents so many essential and adaptive points at one view. The base of the skull is less connected with the wants and habits of the species than most other parts of the skeleton; and lesser peculiarities, when constant, become valuable aids in the higher divisions of classification, as well as in the minor groups of families, genera, and species. For instance, in placental mammals, the internal carotid artery generally passes into the cranium by a foramen in the tympanic bone, or, when that bone is small, by a fissure between the tympanic bone and basi-sphenoid. In the skull of the wombat, and other implacental mammalia, the artery enters by a special *canalis caroticus*, running in an inward and forward direction. This has been considered just as characteristic, in a zoological point of view, of the whole marsupial order, as the articulation of the head to the atlas by a double condyle is of the whole mammalian class itself. The distinction here mentioned was pointed out by a young and zealous comparative anatomist, H. N. Turner, jun., in a series of papers communicated to the Zoological Society of London several years ago. His untimely death, the consequence of a wound received in dissection, in the early part of 1852, deprived science of his services, and has left this field of investigation open to others.

II. *Note on the Discovery of Hematite Iron Ore on the Garpel, Ayrshire.* By ALEXANDER ROSE, Esq., Lecturer on Geology and Mineralogy.

My attention was called to the subject of these notes by the perusal of the following paragraph, which has been published in some of the newspapers:—

" *Important Discovery of Hematite Iron Ore.*—A disco-

very of very great importance to the iron trade of the west of Scotland has lately been made on the extensive mineral estates belonging to the Hon. Colonel Cathcart, situated at Garpel, near Muirkirk. A vast lineal deposit of very rich hematite iron ore has now been fully proved, to a distance of more than three-fourths of a mile, traversing in a nearly north and south direction the porphyritic, arenaceous, and trappean formations, which chiefly constitute the mountainous tracts of the eastern parts of Ayrshire, the geological conditions being analogous to those characterizing the large hematite deposits of Lancashire. During the last twelve months a large body of workmen have been employed in opening up the ground on the course of this valuable mineral, erecting a range of buildings at the mine, and in forming a railway of about a mile and three quarters in length across the moor to the public road. This vast ferruginous deposit is found to be from 20 to 50 yards wide, and constitutes the eastern escarpment of a deep gorge or burn; it has been thoroughly and most effectively laid open to the length of about 250 yards on its line of bearing, and to a depth of some 60 or 70 feet, the whole now presenting the novel appearance of a vast quarry of hematite iron ore; and there are already many thousand tons of it lying in heaps by the side of the tramway, ready for transit to their depot at Wellwood, on the Muirkirk Railway. The Garpel ore has been tested in large quantities at some of the neighbouring furnaces, and pronounced to be superior in quality to the best hematite iron ores of England."—*Ayr Observer*.

This statement must be gratifying, not only to the parties more immediately concerned, but also to the inhabitants of the district and the public in general, since the prosperity of the country at large depends so much on its mineral resources, more especially on its ores of iron. The discovery of this hematite, however, is not new, as was stated in the newspaper announcement. It is now a good many years since I was engaged by the Hon. Colonel Macadam Cathcart to survey and report upon this vast deposit of red hematite, I accordingly examined and reported on the quantity as large, and the quality as excellent; the latter I stated, according to the analysis of red hematite by Daubuisson, to consist of—

	Per cent.
Protoxide of iron,	94.0
Silica,	2.0
Lime,	1.0
Water,	3.0
	<hr/>
	100

This protoxide would yield of,—

	Per cent.
Metallic iron,	65.17
Oxygen,	28.83
Silica, lime, and water,	6.00
	<hr/>
	100

The ore I found to be in four states:—1st, in mammillated or reniform shapes; 2^d, massive; 3^d, granular; 4th, pulverulent—the two latter conditions being the effect of disintegration. The reniform structure is concentric scaly; internally, compact or fibrous. The streak is deep red, which is characteristic. In all its conditions and characters it corresponds with the long-used hematite of Ulverston in Lancashire, and of Whitehaven. The yield of the Garpel ore is, in round numbers, double that of blackband ironstone. In similar terms was my Report drawn out; yet there the ore remained disregarded and useless until lately. But the qualities of this ore were known before my examination of it. Indeed, I met with no one in the district who was ignorant of its existence. Masses of it were piled in ornamental heaps in gardens, and decorated the mantel-pieces of the houses in the vicinity. Fortunately this valuable store has been rescued, not, indeed, from oblivion, but from the neglect to which it seemed to have been doomed. Those interested in iron working had every conceivable encouragement to avail themselves of this valuable deposit. The quality of the ore, rising high and accessible above the level of the burn, where it might to a great extent be wrought out as an open quarry, placed on the gentle slope of a hill side, whence the ore might be conveyed along a tramroad of less than two miles down to the post road; situated in a district abounding in coal; all these tempting facilities were long overlooked. It is now above a twelvemonth since I stated these facts in conversation to a Mr Holdsworth, a zealous explorer of mineral substances, at the same time

mentioning to him the existence of a rich vein of sulphuret of lead, in the same district of Ayrshire, which had been favourably exposed under my inspection. These relations so far excited his attention as to induce him to visit those localities, and upon his return he told me that I had rather understated the importance of these deposits. Subsequently, he informed me that he had taken a lease of the lead, and that he was in treaty about a lease of the iron ore. It is therefore with much satisfaction that I understand the zeal and intelligence of Mr Holdsworth have made him at last disturb the long repose of this mass of valuable iron ore. Thus I have shown that the discovery of the ore in question is not *new*; and I could scarcely forbear making a few remarks allied to the subject. There is another immense deposit of red hematite belonging to the same proprietor, on the southern confines of Ayrshire, upon which, if agreeable to the Society, I shall offer a few remarks on a future occasion.

III. *On the Skeleton, Muscles, and Viscera of Malapterurus Beninensis.*
By JOHN CLELAND, M.D., Demonstrator of Anatomy in the University of Edinburgh.

The anatomy of the electric apparatus and nervous system of *Malapterurus electricus* has been already beautifully elucidated by Dr Bilharz of Cairo.* The results of his investigations can only be expected to be verified with newly-killed specimens at command, and such an opportunity has yet been lacking; but as the genus *Malapterurus* is a remarkable one, and belongs to an interesting group, and since the species from the west coast of Africa has been only recently distinguished by Mr Murray from that inhabiting the Nile, I have, meantime, under the auspices of Professor Goodsir, undertaken an account of the skeleton, muscles, and viscera of the former. I shall notice the differences between it and *Malapterurus electricus*, as far as Dr Bilharz's book affords material for comparison. I am indebted to Professor Goodsir and Mr Murray for specimens.

* Das Electrische organ des Zitterwelses anatomisch beschrieben von Dr Theodor Bilharz, Professor der Anatomie in Kairo, Leipzig, 1857.

Skeleton.

The skeleton of *Malapterurus*, like that of other *Siluridæ*, is remarkable for the flattened shape of the head, and the tendency to coalescence of the facial bones.

The *cranium* may be divided, for purposes of description, into two parts—the cerebral and the nasal. The former portion is, in this species, somewhat of a square form, but tapers a little to the front; the other part is much narrower and longer than the first. Looked at from above, it has this peculiarity, —viz., that the *parietal* bones are absent. The *supra-occipital* bone is well developed; it has no dorsal crest. It articulates broadly with the great frontal bone in front, and laterally with the mastoid and *ex-occipital*. The *ex-occipital* bone presents a foramen for the great lateral nerve, and a process with which the scapula is articulated. The *mastoid* bones complete the posterior margin of the skull, and form the larger part of the lateral margins of the cerebral part. Each presents three processes, the two posterior of which are connected with a Y-shaped cartilaginous representative of a *supra-temporal* set of bones, and the anterior with a bone which joins the *infra-orbital* range. The *post-frontal* bone completes the lateral margin, and combines with the great frontal to form the anterior margin of the cerebral part of the cranium. It presents a long process, which projects laterally from the skull, and to which the sub-orbital chain of bones is articulated. The *great frontal* bone is broad behind, where it enters into the formation of the cerebral part of the cranium, narrow and bifurcated in front, where it forms part of the roof and sides of the nasal portion. By its bifurcation it forms the posterior and lateral walls of a long opening, which is completed anteriorly by the *nasal* and *pre-frontal* bones. The *great frontal* bone articulates with the *supra-occipital*, *mastoid*, and *post-frontal* bones posteriorly, with the *orbito-sphenoid* bones and *inter-orbital* plate, placed laterally and beneath it, and anteriorly with the *pre-frontal* and *nasal* bones.

Turning to the under surface of the skull, we observe that there is no *petrosal* bone. The *basi-occipital* bone underlies at its posterior extremity the thin body of the first vertebra.

It has a slight process on each side, from which springs a short ligament by which the scapula is attached. The *par-occipital* bone enters considerably into the formation of the base of the skull, and presents three foramina for branchial nerves. It articulates with the *basi-occipital*, *ex-occipital*, *mastoid*, and *ali-sphenoid* bones. On its cranial aspect, close upon the *basi-occipital* bone, lies a flat and almost circular otolith, like the one in *Silurus glanis* (Weber). The *basi-sphenoid* bone articulates by a scaly piece with the *basi-occipital*, and in front of this widens somewhat, and articulates with the *ali-sphenoids*, it then becomes narrow and elongated, and enters into the formation of the nasal part of the skull, and is connected with the *orbito-sphenoids*, one on each side, and in front of them with the *inter-orbital plate*, whose flat under surface rests upon it, and anteriorly with the *vomer*. The *ali-sphenoid* bone articulates with the *par-occipital*, *mastoid*, *post-frontal*, *orbito-sphenoid*, and *basi-sphenoid* bones, and presents a large notch anteriorly, which is completed by the *post-frontal* and *orbito-sphenoid* into a large foramen for the exit of the third, fourth, fifth, and sixth nerves. The *orbito-sphenoid* bone presents on its under surface posteriorly a foramen for the optic nerve; and the spiculum of bone which separates this from the above-mentioned larger foramen behind it is prolonged into a stiletto-like process, projecting laterally, and passing between the optic and fifth nerves. In front of the *orbito-sphenoid* bones is the completely ossified *inter-orbital plate*, broad and squamous in form, and resting on the *basi-sphenoid* bone, beyond which it projects as a horizontal lamina on each side, and aids the partition of the orbital from the oral cavity. From its upper surface two *laminæ* ascend to articulate with the great *frontal* bone, and with it complete a segment of the skull. It articulates in front with the *pre-frontal* bones. The *pre-frontals* are fused into one, and form a complete tube, continuous with the segment just mentioned, but divided into two by a vertical mesial septum, and closed in front so as to leave only two foramina for the exit of the olfactory nerves. The upper surface has a double groove for the nasal bone, and is notched posteriorly where it enters into the anterior wall of the opening. At the anterior lateral angle is a smooth surface for articula-

tion with the palate-bone, and the posterior part of the lateral margin is in contact with the pterygoid bone. Its under surface is prominent in the middle line, where it is in contact with the vomer. The vomer is squamous, without teeth, and articulates behind with the basi-sphenoid, and in front with the nasal bone. The under surface of the *nasal* bone passes on in the same horizontal line as the vomer, and terminates in two broad lobes some distance in front of the pre-frontal. Superiorly it expands backwards on the pre-frontal bone, and articulates with the great frontal on each side of the opening.

In the Nilotic species of *Malapterurus*, as represented by Bilharz, the nasal portion of the cranium is much narrower than in *M. Beninensis*, and the opening is reduced to a narrow fissure. The cerebral portion also is much more compressed from before backwards, the supra-occipital bone being much less expanded.

Face Bones.—The *intermaxillary* bones are united by a symphysis which allows of some motion, and each is articulated a little way from its inner extremity to one of the lobes of the nasal bone, without interposition of a cartilage. By this arrangement, although in their natural position they lie in one horizontal plane, they form a decided arch when the mouth is open. They pass outwards and backwards, and their outer extremities are united by ligaments to the hypo-tympanic bones. They are covered with velvety teeth. The *superior maxilla* is feebly developed, and does not reach more than half way to the inferior maxilla. It is attached by fibrous tissue to the nasal bone behind the lobe, and by joint to the anterior extremity of the palate bone. The *palate* bone is small and linear, and passes outwards and backwards to articulate by a facet on its inner aspect with the pre-frontal, and by ligament with the pterygoid bone. The *pterygo-tympanic* series of bones are so closely united as to appear like one bone, and are pulled asunder with some difficulty. They lie in a plane approaching the horizontal. The individual pieces are only four in number,—viz., the epi-tympanic bone, articulating with the skull and with the operculum; the sympletic, thick and irregular in shape, and with hollows for mucous tubules; the hypo-tympanic, articulating inferiorly

with the inferior maxilla, and connected by ligament with the intermaxillary bone; and lastly, the pterygoid, which articulates with the pre-frontal and the palate bone. The *inferior maxilla* consists of only two pieces at each side, the articular and the dental; the last is armed with velvety teeth.

The *operculum* consists of two pieces, massive in structure,—the opercular bone, articulated by a complete joint to the epi-tympanic bone; and the inter-opercular bone, of a triangular shape, with its base attached by ligament to the anterior margin of the opercular bone, and its apex to the articular bone of the lower jaw.

The *infra-orbital* bones are six in number on each side. They are hollow tubes, in which mucus glands take their rise. Five of them form a chain from the process of the post-frontal bone to the side of the nasal bone, and the sixth passes from the posterior extremity of this chain to the anterior process of the mastoid.

The *supra-temporal* bones, as already stated, are represented by a cartilage arising from the mastoid bone by two origins, which unite so as to form a Y-shaped structure, which terminates in the integument at the upper extremity of the branchial aperture.

A similar cartilage, of a linear shape, arises a little farther back from the upper part of the coracoid bone, and also passes outwards to support the integument of the branchial aperture—this being one of the Siluridæ which have the branchial aperture narrow, and the skin hanging so loosely round it that the branchiostegal rays are invisible beneath it. Probably this last cartilage represents the *clavicle*, that bone being otherwise absent.

The *hyoid* arch consists of four pairs of bones. The superior bone (the *stylohyal*) is reduced to a mere nodule like the smallest pin-head. The remaining three are beautifully united. The *ceratohyal* is a hollow cylinder, open at both ends, and the *epihyal* and *basihyal* are hollow caps, which are united to it by suture so as to form one bone, consisting of a shaft and two epiphyses. The *basihyal* bone is separated from its fellow by the apex of the *urohyal*,—a triangular bone with the apex in front and the base behind, lying in the horizontal

plane. The hyoid arch is suspended by two ligaments, one passing from the stylohyal to the epi-tympanic bone, and another from the epihyal to the articular piece of the lower jaw. The glossohyal bone is slender and linear, with a slight prominence at the attachment of each of the four branchial arches; it was mere cartilage in the specimens examined. The superior *pharyngeal* bones are circular, the inferior elongated and triangular, and both pairs toothed like files.

Anterior Extremity.—Only five bones, besides the fin rays, enter into the skeleton of the anterior extremity. The *suprascapula* and *scapula* are replaced by one bone. This bone fits into the notch between the projecting ex-occipital and mastoid bones, and stretching horizontally outwards, it expands and bifurcates, forming a notch into which the coracoid bone fits. From its under surface a long process shoots downwards and inwards towards the basi-occipital bone, its course to which is completed by a short ligament. The *coracoid* bone completes the arch of the shoulder girdle. One of its margins is convex and directed forwards and outwards, and is somewhat flattened where it forms the posterior wall of the branchial fissure. About one-third from its upper extremity the bone becomes abruptly narrow, as if a piece had been cut out of the concave margin which looks backwards and inwards. Its breadth is supplemented by a bone which fits so closely on to it as to seem a part of the same, and whose posterior margin is continuous with the upper part of the posterior margin of the coracoid. It lies on the outer surface of the coracoid bone, and, widening as it descends, articulates broadly with its fellow of the opposite side. The outer surface of the coracoid bone, above the supplementary bone, is in contact with a cul-de-sac of the peritoneal cavity, which contains a lobe of liver. This circumstance, as well as the muscles directed forwards taking origin from the inner surface of the shoulder girdle, shows that the convex margin of the coracoid corresponds to that which in most fishes looks backward and outwards. The supplementary bone consists apparently of the *radius* and *ulna* combined. It presents two large processes toward its upper end: one is vertical, and gives attachment to the outer part of the *pectoralis* muscle; the other is transverse, and perforated

by a foramen, and at its anterior extremity gives attachment to the carpal bones.

The *carpal* bones are only two in number; they are small and linear, and support the posterior two or three of the eight fin rays. The anterior rays are attached to the coracoid bone, in a straight line with the transverse ridge which supports the carpal bones. The fin, when in action, lies in the horizontal plane at right angles to the body of the animal; and the support given to the posterior rays by the carpal bones compensates for the slope inwards and backwards of the shoulder girdle. When at rest, the fish can make the fin lie alongside of its body by flexion downwards and forwards of the carpal bones, which carry with them the most posterior fin rays, and, with the attachment of the most anterior rays for a fixed point, turn the fin round into the vertical plane.

Vertebral Column.—Immediately behind the cranium are a series of altered vertebræ, to be considered anon. They are very similar in both species, and are reckoned by Dr Bilharz as three in number. They are, however, four vertebræ, as I shall show. Counting them as four, there will then be, according to Dr Bilharz, twenty vertebræ of the trunk, and twenty-two caudal in the Nilotic species. The species which we are considering has only nineteen trunk and twenty-one caudal vertebræ. The superior spinous processes of the caudal vertebræ are long and pointed, as are also the inferior spines; but those of the trunk get gradually shorter and thicker as we pass forward, in such a manner that the tips of these processes lie in a pretty straight line from the occiput to the tip of the tail. Every vertebræ, those next the head excepted, presents on each side a posterior articular process, projecting upwards from the posterior part of the body, and a deep notch between this and the neural arch for the exit of the corresponding nerve; also an anterior articular process articulating with the posterior articular process of the vertebra in front, and with its neurapophysis. The spines of the last caudal vertebra are united and expanded into a single broad triangular plate, and the inferior spine of the vertebra in front is likewise flattened. The caudal fin rays are eighteen in number. The pelvic bones are slender immediately in

front of the vent, and in the specimens I have seen are connected with one another by an unossified portion. Each ends anteriorly in two processes projecting forwards. There are six abdominal fin rays. From the pelvis on each side passes outwards a ligament dividing into three parts, which are lost in the aponeurotic sheath of the great lateral muscle. Bilharz pictures it in the Nilotic species.

Modified Vertebrae.—The first vertebra is very small. Its body is narrow, and the basi-occipital bone is prolonged under it. The neurapophyses are separate little linear bones unconnected with the body, and imbedded in fibrous membrane immediately behind the occiput. The first vertebra has no neural spine in this species, although in the Nilotic species its neural spine is a distinct bone, as Dr Bilharz shows. Dr Bilharz mentions another pair of small bones in connection with the first vertebra; but there is good reason to believe that they are only part of the stapes bones, described below.

The second, third, and fourth vertebrae are peculiarly modified, and almost inseparably united; that is to say, in one small specimen I succeeded in pulling the third and fourth separate, but it is impossible to separate the second and third. Dr Bilharz describes the second and third as one vertebra, but they are certainly two. On the visceral surface, the combined body of the three vertebrae exhibits distinctly the junction of the third and fourth by a deep toothed suture, and indications of the still more thorough union of the second and third. It presents in the middle line a large foramen, the opening of a short canal which bifurcates in the substance of the bone, and opens on each side under the posterior margin of the transverse process of the second vertebra. The branchial veins enter this Y-shaped canal, one at each side, and unite in it to form the aorta. The transverse processes of these vertebrae arise from the neural arch. The neural arches of the second and third vertebrae are fused in one continuous lamina, without neural spine, and with a notch in front that fits to a projection of the supra-occipital bone; but at each side a triangular space is left, the anterior part of which is occupied by the little bones in connection with the first vertebra, while from behind them issue the electric and other nerves.

The transverse process of the second vertebra is greatly developed. It lies horizontally at its origin, but as it passes outwards it alters its plane, and describes a curve, with the convexity forwards, and its anterior margin turned downwards. It is adapted to the anterior extremity of the swimming bladder, and is connected by a ligament with the ex-occipital bone. Bilharz considers it as a part superadded to the second vertebra, and calls it by the name given to it by Müller, the spring process (springfederfortsatz), and describes as the transverse process that of the third. From the dorsal surface of the spring process a cylindrical secondary process, the stem process of Bilharz, pass inwards; and its inner extremity is so nearly in contact with the neural arch that it presses against it when the spring process is pressed upwards.

Professor Müller was the first to mention the spring process, and its connection with the swimming-bladder, both in *Malapterurus* and other fishes.* A strong slip of the dorsal muscle connects the anterior surface of the process with the occiput; and by its contraction Müller considers that the process is drawn forwards, and that so the air in the swimming-bladder is rarified; and that, when the contraction ceases, the process springs back into its place by its elasticity. The stem process, by abutting against the neural arch, will prevent too great a displacement of the spring process.

Immediately behind the transverse process of the second vertebra lies that of the third, shorter and broad, lying in the horizontal plane, so that the swimming-bladder, in expanding, will press it upwards. The transverse process of the fourth vertebra is a simple stiliform process, rather shorter than that of the third. Its neural arch is prolonged into a rudimentary spine, and a round foramen, closed by a membrane, is left between it and the neural arch in front. In *M. electrinus*, Bilharz represents this foramen as nearly completed by the latter arch, and a separate bone fitted into the remaining interval, and overlying the two following spines. This bone he calls the spine of the second vertebra. It does not exist

* Müller's "Archiv," 1842, p. 319. He states that the Silurians in which he has observed this apparatus have a narrow branchial fissure,—viz., the genera *Auchenipterus*, *Synodontis*, *Doras*, *Malapterurus*, and *Euanimus*.

in the species before us. On removal of one side of the neural arch of the conjoined vertebræ, the upper surface of the body is seen to be divided by two transverse elevations into three equal parts of the same length as the bodies of the other vertebræ, and the third and fourth are not more distinctly separated than the second and third. Moreover, there are seen three pairs of foramina for nerves, the first passing out above the spring process, the second above the transverse process of the third vertebra, and the third close to the posterior margin of the fourth vertebra. These circumstances leave no room to doubt that we have really to do with three vertebræ united together. The transverse processes of the fifth and sixth vertebræ arise from the junction of the neural arch and body; those behind arise from the sides of the bodies, each pair on a lower level than the pair in front.

In connection with the three first vertebræ are three pairs of little bones, or processes, of the description called Weber's apparatus. The bone belonging to the first vertebra—the stapes—is situated behind and below its neurapophysis. It consists of a linear portion, similar in size and shape to the neurapophysis, and of another portion, oval and hollowed on the inner aspect, and lying at right angles to the lower extremity of the first portion, directed forwards. Bilharz, as above mentioned, describes the linear part as a separate bone, but since he represents them united, in his sketch of the separate bones; and since the stapes of *Silurus glanis* represented by Weber* is exactly the same shape as that of *Malapterurus*, if we include the linear part; and since, in the species before us, I can see no symptom of the portions being separable; I am inclined to think that Bilharz must be mistaken in describing them as distinct bones. The bone in connection with the second vertebra—the malleus—is considerably larger. It lies along the side of the body of the vertebra, and is straight anteriorly, but curved downwards and inwards posteriorly over the lateral foramen in the body of the vertebra. At its centre it is attached by a very slender thread of bone to the upper part of the body of the vertebra, so as to admit of considerable motion. In the *Silurus glanis*.

* Weber, *De aure et auditu.*

there is a small bone unconnected with any vertebra, viz., the incus, joining the stapes and malleus (Weber), but there is no vestige of it in *Malapterurus*. But from the under aspect of the transverse process of the third vertebra a long and slender spiculum passes inwards and forwards between the malleus and the body of the vertebra, and expands into a little plate the size of a pin-head, which lies over the lateral foramen. When the malleus is pressed upon, as it would be by the distended swimming-bladder, its curved extremity presses this little plate down upon the foramen, and its anterior extremity comes in contact with the stapes and presses it inwards. This curious little process, if it exists in the Nilotic *Malapterurus* (which one would be disposed to think it did, from the close similarity of the neighbouring parts), has escaped the eye of Dr Bilharz ; neither does it appear from Weber's account that we have anything of the sort in *Silurus glanis*. As to the function of the little bones in *Silurus glanis*, of which two, the malleus and stapes, are very similar to those in this fish, Weber writes as follows :—" When the superior part of the swimming-bladder is expanded, the malleus is pressed upon the incus, the incus on the stapes, and the stapes on the atrium of the sinus impar, whose water, being propelled into the sinus impar and vestibule, expands and distends the membranous labyrinth. The upper part of the bladder being relaxed, the malleus, by the elasticity of the processus folianus, returns to its old position, and the whole labyrinth is relaxed. Moreover, tremors of the swimming-bladder itself are no doubt transferred to the labyrinth by the ossicula.*"

On the same principle is the arrangement in the fish that we are considering. When the fish descends in the water the ossicula are pressed on, and the labyrinth distended ; and thus a pressure from within is furnished to counterbalance the increased pressure from without. At the same time, the little processes of the third vertebra will be pressed upon the branchial veins, and must more or less impede the circulation in the head and gills ; so that they would appear to mo-

* Weber, op. cit., p. 57.

dify the pressure of blood on the head according to the pressure of water upon the fish.

Muscular System.

The muscles of *mastication* of the *Malapterurus* are remarkable in their relation to the eye. By much the largest mass arises from the whole roof of the skull, as far forwards as the anterior extremity of the great frontal bone, and passes over the optic nerve and muscles of the eye in its course to the articular piece of the lower jaw, into the upper angle of which it is inserted. The eye-ball is situate at its external border. Another mass arises from the upper surface of the tympanic bones, and is inserted along with the preceding; it is smaller, and lies below the eye. Another and slender muscle is attached anteriorly to a process on the superior maxilla, and behind, to the epi-tympanic bone. Thus the structures to the eye-ball, as well as the divisions of the fifth nerve, pursue their course between two great masses of masseter muscle.

The *transversalis palati* muscle arises from the under surface of the basi-sphenoid and anterior frontal bones and the inter-orbital septum, and its fibres pass transversely outwards to the under surface of the pterygo-tympanic arch. The *mylohyoid* arises from the upper half of the hyoid arch, and is inserted in the whole length of the dental piece of the lower jaw. A muscle arises from the posterior border of the hyoid arch and from the inferior branchiostegal rays, and its fibres, passing transversely inwards, are inserted in the middle line on the under surface of the *urohyal bone*, which it is calculated to *elevate*, and it must therefore act as a muscle of deglutition. The so-called *sternohyoid* muscle passes from the posterior border of the *urohyal bone* backwards to the coracoid bone, and lies near its fellow of the opposite side.

The *muscles of the operculum* are three: one arises from the orbito-sphenoid and anterior part of the post-frontal bone, and, passing beneath the long process of the post-frontal, receives additional fibres from the lateral margin of that bone, and is inserted into the superior angle of the operculum, and acts as a levator. Another arises from the side of the mastoid bone, and is inserted into the upper part of the posterior margin of the

operculum, and acts principally as a depressor; and another depressor arises from the posterior margin of the tympanic arch, and is inserted on the under surface of the operculum.

Two muscles pass from the *cranium to the shoulder girdle* to pull it forward. One arises from the under surface of the mastoid bone, and is inserted into the inferior process of the scapula; the other arises immediately outside the former, and is inserted into the upper part of the coracoid bone.

Small muscles attach the branchial arches to the base of the skull. A ligament passes from the superior junction of the two posterior branchial arches to the coracoid bone, and another from the junction of the two anterior arches to the epi-tympanic bone.

Muscles of the Body.—The *recti abdominis* muscles, touching each other in the middle line, extend from the shoulder girdle to the pelvis, and, behind the pelvis, are again continued by two slips which pass from the deep surface of the pelvic bones to the first interspinous bone of the anal fin. External to the rectus, a separate slip of the great lateral muscle passes uninterruptedly from shoulder to tail, and it is at its outer margin that the electric vessels and nerve emerge. It is overlaid behind by the superficial muscles of the anal fin. Separate slips also pass along the dorsum from head to tail, and between them and the main mass is the position of the great lateral branch of the vagus. But what is most worthy of notice is, that the greater number of muscular fibres arising from the coracoid and radio-ulnar bones form a pectoral muscle, superficial to the other fibres of the great lateral, and digitating with them along the side of the fish opposite the extremities of the fifth, sixth, seventh, and eighth ribs. It is an interesting illustration of the transition from the primitive arrangement in flakes to the formation of distinctly-defined muscles. A strong fasciculus, springing from the occiput, is inserted into the anterior aspect of the spring process; and this is the muscle to which Müller has directed attention, and to which reference is made in a previous place.

Viscera.—The throat and stomach are large and wide; so much so, that I found two large shrimps, which had been swallowed whole, in the stomach of a specimen four inches long.

On examining the remains of a number of putrid specimens, I found that they had been feeding entirely on Crustacea. The stomach is about one-third the length of the abdominal cavity. There are no pancreatic coeca; but from the pylorus, which is situated side by side with the oesophageal opening of the stomach, a wide portion of intestine reaches to opposite the lower extremity of the stomach, and presents a very glandular structure, being pitted closely over with clear little follicles. At the end of this duodenum the intestine is suddenly contracted and convoluted. The contracted portion is about twice the length of the duodenum, and opens into a straight and dilated rectum.

The anterior part of the abdominal cavity is deepened by the manner in which the transverse processes are given off from the anterior vertebræ, and the depth so gained is divided into two fossæ on each side of the vertebral column by the perpendicular direction of the spring process. The anterior fossa, situated between the spring process and the occiput, is filled by a lobe of liver; the posterior, behind the spring process, is occupied by the anterior part of the swimming-bladder.

The liver is of a square form, composed of two symmetrical lobes, and from the upper part on each side comes off, by a constricted pedicle, the lateral lobe which occupies the anterior fossa. A large gall-bladder receives the bile by a hepatic duct from each side of the liver, and opens by a bile-duct immediately beyond the pylorus.

No spleen is to be found in any of the specimens, but a chain of masses of fat, broken into irregular angles like the spleen of a carp, lies on the left side of the stomach and in front of the rectum (probably a degenerated spleen).

The swimming-bladder is divided by a constriction opposite the seventh and eighth vertebræ into two parts. The anterior part occupies the fossa behind the spring process, and is somewhat quadrangular; the posterior, the largest, passes back nearly the whole length of the abdomen. The constricted part has less than a third of the widest diameter. From the centre of the anterior division the pneumatic duct comes off; it is short and straight, and enters the superior wall of the

œsophagus. On opening the swimming-bladder, it is seen to be divided by a septum down the middle, which reaches from its hinder extremity to the posterior margin of the body of the fused vertebræ, where it ends in a free margin, in which the pneumatic duct commences. The orifice between the anterior and posterior division of the bladder, on each side of the septum, is only large enough to admit a probe. Four or five rings of muscular fibre encircle at intervals each half of the bladder posteriorly, projecting into it.

The kidneys are but loosely connected with the abdominal wall, and are dilated at their anterior extremities, which fit in on each side of the constriction of the swimming-bladder.

The urinary bladder is very largely developed, and is thrown into numerous loculi.

The testes and ovaries were empty in the specimens examined ; the testes were long and slender,—the ovaries short and thick.

EXPLANATION OF PLATES.

Plate XX.

Fig. 1. View from above of the bones of the head and the modified vertebræ.
 2. View from below of the same.

These two figures, and Plate II., Fig. 1, are marked with the same series of letters and numbers—*a* supra-occipital bone—*b* ex-occipital—*c* par-occipital—*d* basi-occipital—*e* mastoid—*f* great frontal—*g* post-frontal—*h* ali-sphenoid—*i* basi-sphenoid—*k* orbito-sphenoid—*l* inter-orbital plate—*m* pre-frontal—*n* nasal bone—*o* vomer—*p* inter-maxillary—*q* supra-maxillary—*r* palate bone—*s, t, u, v*, pterygo-tympanic range, viz., *s* pterygoid, *t* hypo-tympanic, *u* epi-tympanic, *v* sympletic—*w* opercular—*x* inter-opercular bone—*y* supra-temporal cartilage—*z* infra-orbital range—*α'* dental piece of the lower jaw—*b'* articular piece. 1. Transverse process of the second vertebra (springfederfortsatz)—2. Stem process—3. Malleus—4. Stapes—5. Neurapophysis of first vertebra—6. Thread-like process of third vertebra—7. Body of first vertebra—8. Body of second vertebra—9. Dorsal arch of second and third vertebra conjoined—10. Transverse processes of third vertebra—11, 12. Spinous and transverse processes of fourth vertebra—13. Transverse process of fifth vertebra—14. Posterior articular process—15. Scapula, the ligament joining it to the basi-occipital being represented by a dotted line—*β*. The outlet of the Y-shaped canal, in which the aorta commences—*γ* lateral opening of the same—*δ* olfactory foramen of the pre-frontal bone.

Fig. 3. Vertical section of the modified vertebræ, showing the division of the

conjoined body into three portions by lines— γ lateral opening of the Y-shaped canal— δ , ϵ , ζ foramina for nerves.

Fig. 4. α Coracoid bone— c radio-ulnar bone— b these bones united, and the two carpal bones in the position which they occupy when the fin lies close to the body.

Fig. 5. The hyoid arch— α basihyal— b epihyal— c ceratohyal— d stilohyal bone— e pterygo-tympanic range— f lower jaw— g urohyal bone. The ligaments are shown by which the hyoid arch is hung.

Fig. 6. The pelvic bones.

Fig. 7. Two posterior trunk and two anterior caudal vertebræ.

Fig. 8. Terminal caudal vertebræ.

Plate XXI.

Fig. 1. Profile view of the bones of the head and modified vertebræ. (For the letters and numbers see above.)

Fig. 2. View of muscles on the abdominal aspect— a pectoralis muscle— b , b recti muscles— c , c anterior pelvic muscles— d ligament supporting the pelvis— e , f depressor and levator of the pectoral fin— g space uncovered by muscle, the anterior part of which corresponds to the fossa which contains the lateral lobule of liver.

Fig. 3. View of muscles on the dorsal aspect— a pectoralis muscle— b space uncovered by muscle between the pectoralis and anterior part of the great lateral muscle, with the transverse process of the third vertebra seen projecting under the membranous covering— c , d masseter muscle above and below the eye-ball— e attachment of the other masseter to the lower jaw— f muscle passing from the tympanic range to the supra-maxillary bone— g levator of the operculum w ,— i i the eyeballs— k coracoid bone and pectoral fin— y supra-temporal cartilage— z cartilaginous clavicle. The muscles from the mastoid bone to the operculum and coracoid bone are seen crossed by the last two structures.

Fig. 4. View of the viscera— a stomach— b glandular duodenum— c rectum— d liver partially raised, and the right lateral lobule exposed, while the left is hid in the fossa in which it lies— e electric nerve— f gall-bladder— g bile-duct— h swimming bladder— i , i kidneys— k , k ovaries— l lobulated urinary bladder.

Fig. 5. Swimming bladder, with pneumatic duct.

IV. *Note on an Artesian Spring, which has lately appeared on the Banks of the Almond, near Wester Whitburn, Linlithgowshire.* By ANDREW TAYLOR, Esq.

The spring was found as a bore was being prosecuted in a field on the banks of the Almond, opposite the Red Mill, and midway betwixt East Whitburn and Blackburn. When nearly 17 fathoms depth had been reached, water copiously gushed out of the bore-hole, and was conducted in a tube 7 feet above

the surface. Though the bore-hole is at present plugged up, the gush still continues with great velocity. I exhibit a bottle of the water. It will be found to have a sweet, though harsh taste. It is being now constantly employed in the neighbourhood for domestic uses ; and its appearance has been reckoned a great boon. When 7 fathoms and 4 feet of sands and clays from the surface had been pierced, water began to ooze out. But it was only when the bore had reached nearly its entire depth, —29 fathoms, 2 feet, $6\frac{1}{2}$ inches, principally through shales and sandstones,—that the spring of supply seemed to be tapped. On reaching a bed of sandstone in particular, about 18 fathoms down, the water came off in peculiar abundance. The bore above referred to is about 70 feet from the bed of the river Almond. Another bore was made in the same field about 30 feet nearer the river, through a similar succession of sandstones and shales, but only to the depth of 17 fathoms, 2 feet, 3 inches ; water also issues from this bore-hole, but not with the same vehemence ; its taste, too, is very sulphureous. The depth of the clays and sands from the surface is 10 fathoms 5 feet ; a considerable inclination from the other bore, and sufficient to explain part of the phenomena. In geological position, these springs lie midway betwixt the Bathgate and the Muldron Hills. The contour lines of the surrounding district are very gradual ; and the strata which have been pierced crop out at short distances, dipping N.W., at an angle of 18° or 19° .

In attempting, then, any theory of these springs, their proximity to the river must be held as pointing out their most probable source. The absorbing character of sandstones are well known ; and if we take the source of the river as the upper leg of the siphon, the height to which the water rose in the tube from bore No. I. may be easily accounted for. In support of this view I may adduce the fact, that the French engineers have now agreed that the nearer running streams these springs are sought for, the more likelihood of success ; and that in the plain of St Dennis they cannot be found further than 30 metres from the banks of the Seine. Mr G. Foster, who superintended the bores alluded to, about eighteen months ago encountered a similar spring in the course of his practice at Torrance, near Blackridge, Lanarkshire, about 5 miles from

the site just alluded to. When 310 feet had been pierced, the water gushed out, and continued to issue abundantly, supplying a farm-steading for about a year. But at that time the pumping-engine of a pit, about a mile off, began to play, and thoroughly drained off the spring. Facts such as I have recorded possess a meteorological and petralogical interest, besides their direct economic one. Might not a committee of this Society draw up a series of directions for their observation and registration, and circulate them amongst borers and others? Much useful economic knowledge might thus be rescued from oblivion. Artesian water supply for domestic-use, manufacturing purposes, and irrigation, has been too much neglected in this country. Whilst, then, the geologists of the south are directing public attention to this subject, the instances just noted show that, even in some parts of our northern secondary strata, the requisite conditions exist for the successful search of these springs. It may be remembered that several of them have been successfully bored for in the Mountain Limestone district of Derbyshire.

*Wednesday, 27th January 1858.—ANDREW MURRAY, Esq., President,
in the Chair.*

The Donations to the Library, which included the following works, were laid on the Table, and thanks were voted to the donors:—

1. Proceedings of the Literary and Philosophical Society of Liverpool, No. XI., 1856-57.—From the Society. 2. Transactions of the Royal Society of Edinburgh, Vol. XXI., Part IV. 3. Proceedings of ditto, Session 1856-57.—From the Royal Society. 4. Remarks on the Mechanical Structure of Cotton Fibre. By Gilbert S. French, Bolton.—From George Lawson, Ph. D.

The following communications were read:—

I. *On the Occurrence in Scotland of the Achatina acicula.* By
W. H. LOWE, M.D.

Dr W. H. Lowe read the following note he had just received from Patrick Dalmahoy, Esq., W.S., giving instances of the occurrence of the *Achatina acicula*, in addition to the one he had himself observed and recorded at a previous meeting;* thus establishing beyond a doubt the pro-

* See page 346.

priety of adding this shell to the list of Scottish species.— “ If you think it necessary, you may mention that I found four specimens of *Achatina acicula* eight or nine years ago, in the Park of Binns, Linlithgowshire. They were dead shells, lying at the roots of grass. Sometime before that I found a single broken specimen on Belhaven Sands, near Dunbar, at a point where a stream reaches the sea, and which doubtless had brought it down. Forbes does not say that it is unknown in Scotland, but that it ‘ probably ceases in the south of Scotland. It is described by Montague under the name of *Buccinum terrestre*, and as such it is included in the catalogue of North British shells which is appended to the supplemental volume of Montague’s ‘ British Testacea.’ ” Larkey is considered somewhat doubtful authority by Forbes ; but one of my specimens was got near the locality he specifies. Henry gives England as its only British locality, and M‘Gillivray does not mention it.” Dr Lowe also desired to remark, that his friend Dr William Timplar, of Dorsetshire, had, during a visit to Largs on the Clyde, in 1856, found a specimen of this shell in the valley of the Gogo, near that place ; he did not know whether it was dead or alive when found.

II. *Introductory Report on the Natural History of the Pearl Oyster (Maleagrina margaritifera, Lam.) of Ceylon.* By E. F. KELAART, M.D., Trincomalie. Communicated by R. KAYE GREVILLE, LL.D.

(Of this Report, which was read at length, the following is the substance.)

Having understood that some account of my researches into the natural history of the pearl oysters of Ceylon is desirable, even at this early period of my labours, I shall endeavour briefly to sketch a report, that can only be considered in the light of an introduction to a more extensive and prolonged series of observations which, if means are afforded me, may be brought to a more speedy conclusion than I have any prospect of doing at present. Before I proceed to detail the results of my researches, since I was commissioned by his Excellency the Governor, in March last, to undertake this desirable investigation, I have to acknowledge the great facilities which the *aquarium* gives for the investigation of the natural habits of molluscs, and other moderately sized fresh and sea-water ani-

mals. Without glass aquaria, and a powerful microscope, I should not perhaps have obtained even that information on the minute anatomy and habits of the pearl oyster, which is embodied in this Introductory Report. Soon after my appointment, I ordered out large glass aquaria and other apparatus, which will be of service hereafter to myself, or to those who may be engaged years hence in reporting to Government from time to time the natural condition of the oyster in their various banks. In the meantime, I have made use of large glass globes and Ceylon manufactured aquaria, made of thick crown glass, Roman cement and slate, purchased from the naval store. Large chatties, too, and tubs, are also in use. The oysters thrive best in chatties ; but these do not afford the same opportunity of seeing their habits as glass-sided aquaria. I have also, in addition to the above-named means of observation, had perforated wooden boxes, with a few oysters in each, deposited in various depths of the sea ; and latterly, I have used large canoes (ballams) for the same purpose ; lastly, though perhaps of most importance, I have had unexpected facilities of observation among the several small beds of oysters found in the inner harbour of Trincomalie. They are found of all ages and sizes, and various depths and different kinds of banks ; so that no naturalist has perhaps ever had the same opportunity of observing the habits of the pearly mollusc as I have at present.

. In concluding this first Report, I shall briefly recapitulate the important discoveries I have already made. The pearl oyster is more tenacious of life than any bivalve mollusc I am acquainted with. It can live even in brackish water, and in places so shallow, that it must be exposed for three or four hours daily to the sun, and other atmospheric influences ; that it has locomotive powers beyond any idea which can be formed from former observations ; that the power of moving from place to place is inherent, and absolutely necessary in early life, for the due performance of the animal functions. This is obvious from the fact, that if a cluster of young oysters stayed permanently in one place, adhering to each other, the growth of the animal, and particularly of its shell, would be prevented ; that the pearl oyster will move about in search of food, if the locality in which it is originally placed is not

rich in its natural supplies ; that it will move from its original situation if the water becomes impure, either from the decomposition of vegetable or animal matter, or muddy, and probably too, if there is a large influx of fresh water ; that if the water is agitated to an inordinate degree, the oyster will leave its old mooring-place and seek another ; that a thunder-storm will kill some in an aquarium (query, if thunder storms have similar fatal effects on oysters lying deep in the sea ?) ; that the animal can unfix itself from its byssus, and that crabs, shrimps, and other creatures, force them to form a new byssus, by nibbling through the old one ; that it can re-form its byssus at pleasure, if in good health and condition ; that it can live for a long time without forming a byssus, and that it will re-form a byssus when it has recovered strength ; that the power of re-forming its byssus is not confined to the young animal, but that the largest living oyster I have seen can re-form it in an aquarium, as well as in the depth of the sea, but not so actively as the young and middle-aged. Pearl oysters are gregarious in their habits. In placing several young oysters in different parts of an aquarium, they will sooner or later be found attached to each other. The older ones have also this desire ; but their heavy shells impede their motion, and they are contented to remain apart from their fellows. That, taking the foregoing facts into account, there appears to be no reason why pearl oysters should not be translated from their native beds, and made to colonize other parts of the sea. That the young, as well as the old, are in spawn from March to September, and that probably there is no stated period for spawning. The whole occupation of the oyster, when fixed to a spot, appears to be, keeping its valves open, and admitting food to its mouth. For several hours the valves remain open ; they then close for a few minutes, or for an hour or two, then open again. At night the valves remain generally open till towards daylight, when they close, and remain so till the sun shines brightly over the horizon. It is during the early part of the night, or soon after sunset, that they exercise, *when required*, their locomotive powers. I have watched the oysters in aquaria for nearly a whole night, and they appear to be then active in moving and attaching

themselves to new localities. During the day I have only seen on one occasion an oyster form a new byssus. This nocturnal habit is doubtless instinctive precaution ; for, should oysters move during the day, they are more likely to become the food of fishes and other animals which prey upon them. Their movements are instinctive, and guided by the sense of touch. Darkness suits them better than daylight, of the difference of which they are very sensitive. Most of the oysters in which I have found pearls had external marks of having been retarded in their lateral growth, and displaced in early life from their fixed position on a bank. I am inclined to believe that oysters which have abundance of food, and are not disturbed, remain fixed for the last two or three years of their growth to one spot. These are less likely to have a large proportion of pearl-bearing individuals among them. This of course requires more extensive practical observation, either on the beds in the harbour of Trincomalie, or on the pearl banks of Arrippo. With reference to the formation of pearls, I have nothing new to add to the accounts found in the best modern books on the subject, except that one which modifies the view taken by Sir E. Home,—viz., that pearls are formed from abortive ova. I believe the ova left behind in the ovaria are not the nuclei of pearls, but that the ova which escape through the extended coats of an overgrown ovarium, and are imbedded in the interstices of the mantle, become nuclei of pearls formed in this situation. I have repeatedly examined seed, or young pearls, in process of formation ; and, with a magnifying power of 1·5 inch lens, I was able to see distinctly the outlines of two and three ova, through the first or superficial layer of nacre, surrounded by groups of ova. It can be readily understood how an overcharged ovarium will, by some accident or spontaneous evolution, have its coats ruptured, allowing the ova to escape, and become inserted in the contiguous attenuated parts of the mantle. As pearls are more usually found imbedded in the mantle near the hinge, —the most likely place where the ovarium is liable to rupture,—I consider this very conclusive of the new theory I have here proposed. I may also observe, that I have seen the vestiges or cicatrices in the mantle where the pearls once existed.

Though pearls originate in the mantle, when large they work their way out, and lie loose between it and the shell, or become attached to the "mother-of-pearl" surface of the latter. I have no doubt that pearls can work their way out from this position, and be found entangled in the meshes of the byssus. I also consider it very possible that an over-distended ovarium is one of the causes of pearls being discharged from the oyster and lost. If this be really the case, it will easily account for the singular fact, that a sample of oysters fished in the month of October will yield a larger proportion of pearls than a batch of oysters fished from the same bank in the months of April and May of the following year. These observations are somewhat suggestive, and can be improved upon by future investigation. I have now drawn to a conclusion this Report, which, I fear, has extended to a greater length than will suit the patience of the reader. But the subject being one which has been so long neglected, and so little understood, I hope that the Government which has engaged my services, if they do not consider my endeavours as already productive of some practical results, will at least see in these researches glimpses of future success. It is due to Sir Henry Ward here to acknowledge my grateful thanks, in which my brother naturalists in all parts of the world will, I am sure, join, for the gracious manner in which my humble services have been retained, for investigating, fundamentally and practically, the natural history of a species of shells which, from the darkest ages of the world to the present time, has been considered of inestimable value in producing one of the richest of gems. Time was when the product of pearl oyster fisheries founded cities in South America and the Red Sea. But what is the state of the islands of the Red Sea, "whose merchants were princes?" They are now thinly inhabited by a miserable race of fishermen. The sites of some of the oyster-banks in South America are not even now known; they have been destroyed by being over-fished. New beds are doubtless forming in localities to be yet known to future generations. Ceylon pearl-banks were once on the point of sinking into the same fate, but for the subsequent observance of more caution. I was present at two of the largest fisheries ever made off Arrippo in 1835 and 1836.

The oysters fished during the first half of the fishery were full-sized, and yielded a good price, most of the speculators making handsome profits. Government was encouraged to pursue the fishery; young oysters were taken up; many of the purchasers, inflated with former gains, purchased readily, and were ruined; and, I believe, to this day these over or prematurely-fished banks have not been very productive, although twenty years have since elapsed. If the same incautious and unscientific plan were adopted on the oyster banks in England, similar results would soon be perceived there. Not a "native" would be had in London, nor even a cultivated one seen anywhere. If Government desires to have a steady, and not a precarious revenue, from pearl oyster fisheries, let good laws protect the beds already known, and those that are now forming; and let means be adopted to secure their increase and growth. In one year more oysters are consumed in England than were fished on the banks of Arrippo last year; and this consumption is repeated year after year without exhaustion; simply because the natural laws having been once found out, they are allowed to operate fairly. It will, indeed, be a very great source of satisfaction to me if any of the natural laws I have described in this Report suggest to Government an improved system of management. My attention has also been directed to the natural history of the Tamblegam oyster, *Placuna placenta*. I have a few still alive, which were translated in May last. If this oyster can be successfully translated, the whole of Batticaloa lake might be converted into a large ostrearium. The *Placuna placenta* has no byssus, and can therefore be more readily transported. Their removal from their native beds does not necessarily destroy the internal parts: About one-third of the pearl oyster *Meleagrina* die from being injured by the force necessarily applied when detaching them from the rocks to which they adhere. I have also lately "doctored" some pearl oysters, according to the plan adopted by the Chinese in the case of the large fresh-water mussel; but which method, I believe, has never been attempted with the real pearl oyster. Time and further experience are required to ascertain the results of this practice in Ceylon. Dr Gray of the British Museum has, I believe, by the application

of the same means, succeeded in producing pearls in the edible mussel or oyster of England. It may therefore be hoped that I shall eventually succeed with the pearl oyster of Ceylon. All that I can at present say is, that they do not die under the operation, and that they are still living, having also re-formed new byssuses. This is the only way the period required for the formation of good sized pearls can be ascertained. There are some other points in the natural habits of the pearl oyster which I reserve for future Reports, as precipitate conclusions may mislead the Government.

Through the kindness of Patrick Dalmahoy, Esq., W.S., specimens of the *Meleagrina margaritifera* were exhibited; and also the large fresh-water mussel of this country, *Unio margaritiferus*, in which our native pearls are chiefly found, as well as several fine specimens of Scottish pearls from Argyleshire.

One of the members of the Society having stated that, according to fishermen, the common mussel could not refix itself after having been removed from its attachment, Dr Strethill Wright said that such an opinion was incorrect, the mussel could cast off its byssus and renew it at pleasure, moving from place to place in the meantime. The threads of the byssus were moulded in the groove of the foot. He stated, in reference to the pearl oyster living in brackish water, that the common oyster thrives in fresh water, and thought it not impossible that it might be kept in this way, and fed for economic purposes.

II. Exhibition of Lignite from the Ballarat Gold-Field, and of some specimens of recent Woods from Australia. By WILLIAM OLIPHANT, Esq.

Mr Oliphant stated that some time since he had received from John L. Currie, Esq., Lara, Victoria, several specimens of lignite or bituminous wood, which possessed considerable interest. They had been procured on a visit to the Ballarat gold-field, which is situated about 75 miles from Melbourne, in a deep sinking, from a stratum at about 170 feet from the present surface. This stratum was several feet in thickness, and contained many large and apparently nearly perfect trunks of trees, which must be the remains of a dense and extensive forest. The lignite overlies the deposit in which the gold is found, and may possibly serve as an index to the position of gold in other localities. The lignites exhibited are of a gray-

ish-black colour, externally earthy, but when broken across exhibit generally a glossy lustre, somewhat resembling the fracture of jet. They burn easily, with a considerable flame, and emit a vapour of a harsh bituminous odour. From a rough trial, much gas is yielded during combustion. Lignite has also been found in other parts of Australia; and, being so abundant at Ballarat, might be applied to various economic purposes in public works, though its disagreeable odour would render it objectionable for domestic use. A portion of it was examined microscopically by Mr A. Bryson, who ascertained it to be an Araucarian conifer; and he thinks it probable that it belongs to a more recent flora than those found in a silicified state, which appear to be of the Tertiary period, thus indicating that in all probability the strata covering these lignites are of the older volcanic rocks. It is somewhat remarkable that trees analogous to the Araucarian pine predominated during almost every vegetable era. Thus the huge trunks of Craigleith and Granton in the coal formation, the fossil trunks of the Lias and other secondary periods, and the lignites of the continent of Europe, and Devonshire, with many of the silicified woods of Saxony, Egypt, Antigua, Australia, and Van Dieman's Land, are believed to be principally Araucarian.

Mr Oliphant also exhibited a number of specimens of recent woods from Australia, some of which seemed well adapted for manufacturing purposes, being beautifully grained, and susceptible of a high polish.

III. *Entomological Notes for 1857.*

1. *Lepidoptera.* By R. F. LOGAN, Esq.

2. *Coleoptera.* By ANDREW WILSON, Esq.

(Numerous specimens were exhibited.)

1. *Lepidoptera.*

It has again become my duty to report on the proceedings of the Entomological Committee during the year that has just passed over our heads; and I do so with the consciousness that we have accomplished very little in one of the finest seasons, perhaps, that entomologists have ever known in this country. It is long since we have had a season in which the average temperature has been so high, accompanied during

the summer by a large amount of dry weather. The consequence has been great activity among the insect tribes, and the occurrence of many rare species throughout the country in unusual abundance, especially in the southern counties of England. In Scotland, we have the occurrence of *Colias edusa* recorded for the first time in anything like numbers, and many other species have been equally abundant; while the extreme mildness of the autumn and winter, added to the warmth of the preceding summer, has caused some rather singular aberrations in the economy of various species. Notwithstanding all this, I have to record the addition of only nine species of Lepidoptera to our local list; and several of these, although occurring at a moderate distance from Edinburgh, are not strictly within the bounds of the county, which is very irregular in its outline. Most of them are small species, the only conspicuous one being *Noctua triangulum*, which was reared by Mr Wilson from a larva found on Corstorphine Hill in the spring. It is the first known instance of its occurrence in this neighbourhood, though it is found at Rannoch and in the west of Scotland.

Noctua triangulum.....Corstorphine Hill. Mr Wilson.
Simæthis pariana.....At rest on the bloom of ragwort. Belstane, on the Lanark road. August.
Penthina prælongana.....Bred from larvæ on birch collected in the autumn of 1856 at Drumshorling.
Gelechia notatella.....Bred from larvæ on *Salix caprea*, collected in 1856 at Drumshorling.
Argyresthia pygmæella.....Bred from larvæ on birch at Drumshorling.
Ocnerostoma piniariedella....Beaten out of *Pinus sylvestris* at Drumshorling, in May.
Bucculatrix aurimaculella.Bred from larvæ in leaves of *Chrysanthemum leucanthemum* in Leven Quarry, Musselburgh.
Nepticula floslactella.....Beaten out of pines at Drumshorling in May.
Nepticula — ?Birch at Drumshorling in April, and bred from miner in birch leaves collected at Belstane in August 1856.

As early as the month of February, the larvæ of *Spælotis lucerneæ* were found in considerable numbers on the stony debris of Salisbury Craigs, frequenting the driest and most barren spots, where often the only vegetation was the common

biting stonecrop (*Sedum acre*) ; on this they feed with avidity, and also on such scanty grasses as may fall in their way ; but, from the nature of the ground, they must often travel a long way to find a meal. These conditions, however, seem essential to the existence of the species, as it is never found where there is the least tendency to moisture or luxuriance of vegetation. Mr Stainton, in his "Manual of British Lepidoptera," gives the dandelion (*Leontodon taraxacum*) as one of its food-plants ; but this is certainly not its natural food here, as the plant is scarcely found where the insect occurs.

On the 23d of April, the elongate green larvæ of *Thera simulata*, and the curious reddish, variegated, and twelve-footed larvæ of *Elloptia fasciaria*, were found upon Scotch fir in Drumshorling Wood. But few moths were astir as yet ; although one specimen of a *Nepticula*, new to the district, was captured, and a ♀ *Trachea piniperda* was shaken out of one of the pines, and in the course of a day or two deposited a few eggs of the usual type peculiar to the Noctuidæ. The young larvæ produced from these, which did not hatch till the 20th of May, exactly three weeks after they were deposited, would not touch the leaves of the pine at first, but fed for some time entirely upon the flower-buds at the extremities of the branches.

In the course of a second visit to Drumshorling, on the 21st May, *Nepticula floslactella* was found in abundance in some of the pines, where it had apparently taken refuge from the weather, as it is not a pine, but a sallow feeder. Two specimens of *Ocnerostoma pinariella*, a legitimate pine-feeder, were also found ; and the larvæ of *Oporobia autumnaria* were not very uncommon on the birches. The young larvæ of *Xanthia flavago* were also found still feeding in the catkins of the sallows.

On the 2d of May the larvæ of *Gelechia instabilis* were found on the coast at Morrison's Haven, beyond Musselburgh. They bore down the shoots of *Plantago maritima* into the tough woody stem, and must often be covered by the tide at high-water. On the same day a very interesting addition was made by the discovery of the larvæ of *Bucculatrix aurimaculella* mining in the leaves of *Chrysanthemum leucanthemum*

in Leven Quarry. The larvæ of this species, like the rest of the genus, have the singular habit of living, during the first part of their existence, as miners in the parenchyma, and afterwards emerging, and spinning themselves up in flat circular silken cocoons on the leaves, where they change their skins, and then, leaving their retreats, they feed externally, like other larvæ, till full grown. Leaving the coast, and proceeding along the banks of the Esk, the larvæ of *Lampronia quadripunctella* were found in some numbers boring in the buds of the wild roses on the sides of the river.

Having again obtained eggs of *Petasia nubeculosa* from Rannoch in Perthshire, I succeeded last summer in rearing the larvæ, and found they fed indiscriminately on birch, elm, lime, alder, and various species of fruit trees; so that there seems no reason, if the occurrence of their food were the only thing which influenced the distribution of insects, why this species should not be spread all over the country. I also succeeded in rearing *Coremia Salicata* and *Aplocera flavicinctata** from the egg. The former is an instance of the small amount of dependence which can be placed in specific names as indicating the habits of the insects to which they refer, the larva feeding not on *Salix*, but on the various species of *Galium*; the latter, which has sometimes been considered doubtfully distinct from *Aplocera cæsiata*, is, I have no doubt, a perfectly distinct and good species; and I hope to prove that it is so, during the ensuing summer, by rearing *cæsiata* likewise from the egg.† The most conclusive proof has been obtained, on the other hand, during the past season, of the complete identity of the two supposed species of *Eupithecia*, *subfulvata* and *cognata*, both having been reared from eggs deposited by the same insect. The larvæ of *Aplocera flavicinctata* were fed on *Saxifraga hypnoides* and *granulata*, in an open glass cylinder placed in a flower-pot in the garden, and were always most active and voracious during wet weather, and, when saturated with moisture, pointing out

* *Ruficinctata*, Guenée.

* Since this paper was read the second volume of M. Guenée's "Phalænites" has appeared, and he is of opinion, not only that our Highland species is distinct from *Cæsiata*, but that it is distinct from the *Flavicinctata* of Hubner.

the natural habits of the species, on the northern and eastern sides of the Highland mountains, and doubtless in boggy spots, where many of the mountain saxifrages grow. The eggs hatched on the 26th of August, and about one-half of the brood fed rapidly, and changed to pupæ early in October, the moths appearing from the 7th to the 20th of November ; while the rest of the brood are still quite small, and have passed the winter among the saxifrages in the cylinder. A few of those which came to perfection deposited eggs ; but these have not hatched, and I suspect will not prove fertile.

About the middle of July I received eggs of *Dosithea immutata* from the neighbourhood of Ardrossan, through the kindness of Dr Colquhoun, and also an active brown *Tortrix* larva, which he had found in the earth upon some rocks in the vicinity, and which fed, after I received it, upon grass. I at once suspected, from its size and appearance, coupled with the locality from which it had come, that it was the unknown larva of *Sciaphila bellana* ; and accordingly, after the lapse of some weeks, a crippled and imperfect, but undoubted specimen, of *Sciaphila bellana*, var. *Colquhounana*, made its appearance, thus affording a clue to the habits of the species by which its transformations may be satisfactorily worked out another season. The *Dosithea* larvæ fed on *Lotus corniculatus* ; but I did not succeed in keeping them through the wet weather in the autumn, moisture being as inimical to them as it was favourable to the larvæ of the *Aplocera* before mentioned. Of another species of the same family, however, *Acidalia fumata*, which frequents naturally damper and lower lying situations, I have preserved a few larvæ so far through the winter, though whether I shall rear them or not, remains yet to be seen.

2. Coleoptera.

Giving priority to the most interesting, a couple of specimens of the rare *Calathus nubigena*, Halliday, one ♂ and one ♀, have been taken on the Pentland Hills,—the first in May, on a level moor about 850 feet above sea-level ; the second late in September, near the top of one of the hills, fully 1400 feet in height. Previous to these captures, the

only known localities were the tops of a few of the higher hills in Ireland (heights varying from 2700 to 3000 feet), where the species was discovered in 1838, and has since been sparingly met with in early summer only. These Scottish specimens were forwarded to, and closely examined by, Mr Dawson of Bedford, who was at the trouble of procuring a specimen from Ireland for comparison, which he was afterwards so obliging as to send here, so as to enable me to satisfy myself, and also to obtain the opinion of Mr Murray, which was, that they were identical with the Irish type.

Calathus micropterus, generally rather a scarce species, was found not at all uncommon on various parts of the Pentlands. They prefer fir woods, among the debris of which they are very conspicuous, from their shining black colour, but owing to the nature of the ground, are rather difficult of capture. They seem equally active the whole season, from May till October. Not having met with any at a lower level than 800 feet, and, with the exception of one exposed locality, nearly double that height, always in woods, I have no doubt but that one of the localities given for it in Mr Murray's catalogue, "Musselburgh Links," is misplaced, and ought to be referred to *C. ochropterus*, which precedes it in the list.

Of *Pterostichus aethiops*, given in the same catalogue as "not common, west of Scotland;" one ♂ and two ♀ have been taken high up on the Pentlands, along with its common congener, *madidus*.

Specimens of *Omara oricalcica* and *Bembidium femoratum*, not previously found in this neighbourhood, have been taken at Bell's Mills.

I may add, that *Lema asparagi*, mentioned in the "Entomologia Edinensis," as having occurred near Edinburgh, but which Mr Murray has excluded from the list of Scottish species, has been taken near Monkton, Ayrshire, by Mr J. P. Duncan; so that we may anticipate its being in reality one of our local Chrysomelidæ.

IV. (1.) *On the Genus Peltogaster (Rathke); an animal form parasitic on the abdomen of crabs.* (2.) *On the occurrence of the Galathea Andrewsii.* By JOHN ANDERSON, Esq.

(1.) *On the Genus Peltogaster (Rathke).*

My attention was first directed to this remarkable genus of animals in the spring of 1855. Being then engaged in examining the different species of the *Paguridae* in the Firth of Forth, I was astonished to find attached to the left side of the abdomen of a specimen of the *Bernhardus* a bright yellow-coloured sac, resembling in miniature a ripe cucumber. So intimate was its connection to the abdomen of the crab, that at first it appeared to me to be an abnormal structure connected with the organs of generation; but, on a careful examination of the points of connection, and upon dissecting the sac itself, I was led to consider it a distinct animal. Having convinced myself of its individuality, I consulted all the British works devoted to the consideration of parasitical animals, hoping to find it described in some of them, but my labours were without success. Last January, having had occasion to consult the *Annals of Natural History* for September 1855 on an altogether different subject, I had the good fortune to meet with the translation of a paper by Professor Steenstrup, in which he discusses the true nature of these parasites. Upon reading this paper, I not only found the parasite I had observed on the *Pagurus Bernhardus* referred to, but also another described as infesting the *Carcinus mænas*. At the next low tide I visited the shore of the Firth at Joppa, and my search was rewarded by a plentiful supply of specimens of the last-mentioned parasite. The specimens were chiefly found on the *Cancer pagurus*—the *C. mænas* supplying me with very few.

The bibliography of the subject is very extended, embracing the various opinions which have been advanced by Cavolini, Rathke, Schmidt, and Steenstrup, as to the systematic position of these parasites. From the conflicting views which have been advanced regarding the true nature of these enigmatical parasites we are led to appreciate the difficulties of the subject, and warned against rash generalizations. From

the anomalous character of their structure, I believe that their systematic position can alone be determined by accurate observations on the development of the embryo, and careful dissections of the animals themselves. The distribution of these parasites in Europe appears to be very wide, especially that of *Peltogaster carcinii*. Specimens of this species have been obtained from the coasts of the Mediterranean, Crimea, Norway, and from the "Black Banks" in the North Sea. Professor Bell was the first to notice it on our coast; and I have also to record it as a British parasite.

The *Peltogaster paguri* does not appear to be so extensively distributed as the former species. Rathke, who first described it, obtained his specimens from the Norwegian coast; Kroyer appears to have met with it in the Kattegat. As this species has never been recorded as a British animal till now, I shall confine the remainder of my remarks to the consideration of it.

Habits and External Characters.—The invariable position of this parasite is on the left side of the abdomen of the crab it infests, immediately below the false feet. They may be found from spring to harvest, and during the early part of summer are usually filled with eggs. The size varies with the crab on which it lives. The colour is orange-yellow, tinged with copper-green. All organs of sense are absent, and it presents the appearance of a well-filled sack tied at the mouth. It forms a moderately-curved oval, terminated in a short snout, which opens into the cavity of the body. This opening is crenated, and always directed to the thorax of the crab. I have observed in this parasite a remarkable systolic and diastolic-like movement of the whole body, but the object of which I cannot as yet explain. The disc by which the *Peltogaster* attaches itself is of a horny consistence, and is situated in the middle of the body. It is star-like in form; and by means of it these parasites are so deeply rooted into the body of the crab in which they live, that they are unable ever to leave their position. While speaking of the disc, I may mention a fact in connection with it, for which I am indebted to Dr T. S. Wright for directing my attention. It is this, that through the opening which exists in the centre of the disc

there issues a tube, which, in making its appearance in the body of the crab, breaks up into an innumerable quantity of copper-coloured tubules, which ramify through the whole body of the unfortunate Bernhardus. I have detected these tubes passing to the base of the antennæ, ramifying through the claws, thorax, and abdomen, and giving to the soft and transparent parts of the crab a well-marked greenish hue. The function of these tubes is evidently to supply the body of the parasite with nourishment. Cavolini and Professor O. Schmidt, from their observations of the development of the embryo in *Peltogaster carcinii*, were led to consider it as an undoubted crustacean. Professor Steenstrup justly remarks, that from Cavolini's observations there can be no doubt as to the true crustacean nature of the *Peltogaster carcinii*, and that its sack-like form is the result of its parasitic mode of life; and he observes, that if *Peltogaster carcinii* is a true crustacean, analogy leads us to regard *Peltogaster paguri*—the embryo of which has never been observed—in the same light. I was fortunate enough some time ago to meet with a specimen of the *P. paguri* containing eggs. Though I am unable at present to give a description of a fully-developed larva of this species of *Peltogaster*, yet I observed sufficient characters in the various stages of development of the embryo to convince me of its crustacean nature. I can only plead, as an excuse for the very meagre character of this communication, the difficulty I had in getting specimens of this parasite for my observations; and I hope to be able to lay this subject in a more complete form before the Society at some future meeting.

(2.) *On the Occurrence of the Galathea Andrewsii.*

This little *Galathea*, which was figured and described by Professor Kinahan in the Proceedings of the Natural History Society of Dublin for 1856-7, I dredged in Shetland in considerable numbers last August. It is therefore to be considered as a Scottish species; and I have no doubt but it will be found in other localities. I subjoin the specific characters, as given by Professor Kinahan:—"G. rostro brevi, 3·5 dentibus utrinque ornatis. Pedibus anticis rotundatis elongatis angustis sparse tuberculatis tubercululis spinos sæpissime terminantibus.

Chelis digitis parallelis, elongatis angustis recto minute denticulato, apice aduncō; maxillepedibus externis articulo secundo tertium aequante."

I have since found it in our own Firth of Forth in considerable numbers.

Wednesday, 24th February 1858.—WILLIAM RHIND, Esq., President, in the Chair.

Henry Paul, Esq., and James Boyd Davies, Esq., were elected members of the Society.

The following Donations to the Library were laid on the table, and thanks voted to the donors :—

Memorias de la Real Academia de Ciencias de Madrid, tomo IV., 3a serie; Ciencias Naturales, tomo 2o, parte 2a; Programa de premias para el año de 1858.—From the Royal Society of Madrid. The Canadian Journal of Industry, Science, and Art, conducted by the Editing Committee of the Canadian Institute. New Series, No. VII.—XII. January to November 1857.—From the Canadian Institute, Toronto, Upper Canada.

The following Communications were read :—

I. (1.) *On Tiliqua Fernandesii* (Matricida lugens, Murr. in litt), a Lizard said to be venomous, from Old Calabar. By ANDREW MURRAY.

At all times lizards have been an object of suspicion to the vulgar; and even in this country, the harmless *Lacerta agilis* and *Zootoca vivipara* are looked upon as venomous by many of the country people, and treated accordingly. It is not to be wondered at, therefore, that in countries where their size is greater, their form more grotesque, or their colouring more startling, similar notions should be entertained by other and less educated people. That such notions, however, are erroneous in the great majority of instances, if not in every case, cannot be doubted. Notwithstanding the prejudices entertained against them, we know that our European species are perfectly innoxious. Their anatomical structure sufficiently attests their inability to injure, and the contents of their stomach the innocence of their lives; and the natural inference is, that the prejudices felt against other species of the same class elsewhere are equally unfounded.

Still, there is seldom smoke without some fire ; and the fact, that in almost every country a belief exists in the venomous nature of some one or other of the species of lizards, should make us pause before refusing absolutely to admit the possibility of there being lizards which are venomous. No later than the month of January in the present year, we read in the "Zoologist," p. 5921, of the occurrence of such a creature in Gujerat ; to which confirmatory evidence is borne by a sceptical M.D., who ascertained that the poison fangs were in that instance well developed.

We must not, therefore, ignore the existence of such reptiles. There is nothing, so far as we can see, in the structure of their head incompatible with the existence of fangs. No doubt, in serpents the bones of the head are not consolidated together ; but this peculiarity belongs to the whole race, equally to those bearing fangs as to those without them ; and we can perfectly conceive of the bones of the head of a lizard being so altered and modified as to admit of the reception of a moveable fang, although the necessary modifications would be very considerable. I was, and still am, therefore, quite open to the idea of a venomous lizard being *possible* ; and when I first received intimation that such a lizard was coming home, I was delighted with the idea of proving the existence of a hitherto undiscovered, though suspected animal, and did not receive it, on its arrival, with more than reasonable distrust of its venomous pretensions.

The first specimen which I received was a small one, sent to me by Mr Wyllie, a most intelligent and successful observer, who is now, alas ! no more, having succumbed to the baneful influence of the climate. Subsequently several larger individuals were sent to me by the Rev. Mr Waddell, who is still at his post at Old Calabar, in the vanguard of civilization and Christian conversion.

They had all suffered greatly from being sent home in spirits ; but when alive, I am told that it is of the greatest beauty, its colours being of a dark brown, relieved by patches of brilliant scarlet and dots of clear white.

Mr Wyllie describes its cry as inexpressibly melancholy, especially when heard at night, when it was chiefly, if not

solely, heard. He was never able to accustom himself to it, and never heard it without a thrill passing through him, such as he supposed might be the case with one who heard the Irish banshees (and believed in them). It is known by the natives under the name of *owuri* or *owari*, a name having some resemblance to its cry. They have a tradition accounting for the melancholy nature of the cry,—simple, like the story of a child, as all their traditions are, but containing incidental allusions which throw light both upon the manners of the people and the productions of their country. It is this:—The *owuri* went into the forest one day to get something for its dinner. It gathered a great quantity of pumpkin leaves, and brought them home and gave them to its mother, that she might cook them for dinner, and then went out again. The mother put the leaves into the pot to boil; but it is the nature of pumpkin leaves to boil away almost to nothing, and by the time they were boiled, instead of a great dishful there was nothing left but a little handful in the bottom of the pot. By and bye the *owuri* came back for his dinner, and when he saw the little quantity remaining, he thought his mother had eaten all the rest up, got into a great rage, took up a stick and struck her on the head, so that he killed her. He had still to procure his dinner, however; and he again went out and gathered a fresh supply of the same leaves; returned, and set about cooking them himself. When he found that they were boiling rapidly away, it began to dawn upon him that he perhaps might have been too hasty with his mother; and when he finally found that they had diminished to a similar handful to that cooked by her, he awoke to a full sense of remorse for his crime, and rushed frantically from the house, calling out, “Ou-ai, Ow-ai—I’ve killed my mother, I’ve killed my mother—Ou-ai, Ow-ai;” and from that day to this has continued making the same lamentation, the dolefulness and eeriness of which have so impressed the feelings of the missionaries. The natives hold it in great dread, believing its bite to be very venomous, even when the reptile is young, and actually fatal when of a larger size.

It belongs to the group of *Scincidæ*, which have certainly, in outward appearance, more resemblance to snakes than any

of the other lizard tribes, although it is not to them usually that venomous properties have been most frequently attributed. It is mostly to the geckos among the lizards, or the salamanders among the Amphibia, that such properties have been ascribed; possibly originating in the repulsive appearance which they bear, and both having much less affinity with the snakes than the *Scincidae*, to which the *Sepsidae* are nearly allied, which are almost snakes, the feet being reduced to the smallest rudiments; still the passage leading not to the venomous snakes, but to the innocuous species.

On examination, however, I soon found all such speculations to be premature and unnecessary. The lizard is as thoroughly innocuous as any earth-worm. Its teeth are all small, blunted, and cylindrical, quite regular, and fixed all round and confined to the jaws (there being no palatal teeth); and no fang, or any approach to a fang; and no tube, or appearance of duct, in any of them. A gland secreting poison was scarcely to be expected in such circumstances, but was carefully searched for, and found wanting. On examining the stomach, I found it pretty well filled with grasshoppers, crickets, and annellides. The remainder of its anatomy offered nothing of particular interest or peculiarity. It is therefore unnecessary to enter into details upon it.

When I first examined it, it appeared to me to form a new genus, allied to Dr Gray's genus *Tiliqua*, or the American tribe *Diploglossus*; but I was induced to separate it from it on account of its wanting palatal teeth, the possession of which Dr Gray gives as one of the characters of the section in which he places *Tiliqua*, and I accordingly named it *Matricida lugens*, from the native tale which I have narrated, and distributed it under that name. On communicating it, however, to Dr Gray, he informs me that it is the same animal which he described in the catalogue of specimens of lizards in the British Museum, 1845, under the name of *Tiliqua Fernandi*, and that the absence of palatine teeth in this species is not a character on which much confidence is to be placed; and he mentions that he knows some true *Tiliqua* which have no palatine teeth, and others which have them when young, but not when adult.

Seeing that this character is so variable, it is clear that it should be deleted as one of the characters of the group, and that the utmost value which can be allowed to it (if even that) is specific.

I take this opportunity, therefore, of modifying Dr Gray's generic character to this extent.

I would also point out that his specific description, having been drawn up from specimens in spirits, is inaccurate in point of colour. The oblique cross brown bands along the brown sides of which he speaks should be bright scarlet or vermillion—a mode of colouring in this order which I suspect is more frequent than the colours shown by the specimens we receive in spirits, or stuffed, would lead us to suppose.

2. *Observations on the Metamorphoses of Orthopterous and Hemipterous Insects (supplemental to previous communication on the Leaf Insect, Phyllium Scythe).* By ANDREW MURRAY, Esq.

It may be in the recollection of some of my readers that about two years ago, in pronouncing the funeral oration of the leaf insect (*Phyllium scythe*), which had passed its life in the Royal Botanic Gardens here, I took advantage of certain particulars which had been observed in its structure and mode of growth, to submit to the public some new views as to the metamorphosis of hemipterous and orthopterous insects.

The course of life of these insects is to emerge from the egg in the shape of a six-legged insect, resembling the perfect insect in form, but without wings, and with different antennæ; and this stage had hitherto been held to correspond to the caterpillar or grub state, and the insect was then called a homomorphous larva. On changing its skin, the animal made an advance in resemblance to the perfect insect, but had still only the rudiments of wings. This was conceived to correspond to the pupa state; and the insect in that state was called an *active* or homomorphous pupa. The third and last change of skin revealed the perfect insect provided with wings.

The view which I suggested was, that both the larval and pupal stage were passed in the egg, and that the six jointed-legged creature, resembling the perfect insect, but without

wings, which we were in use to call the larva and pupa, was only an undeveloped perfect insect, which underwent changes of skin towards the termination of its life, instead of at the commencement, as is the case in those insects which do not undergo what was called a semi-complete metamorphosis.

It had been previously observed (*Owen*), that in its earliest stage the insect passed a portion of its life in the egg, in the form of a grub; but this was rather looked upon as an early phase in the development of the creature, and that the larval and pupal stages were still passed in the active state to which I have referred.

Further observations have confirmed me in the view which I then announced; and without going into any argument on the subject (for which I would refer to my former communication), I would now wish to put on record the stage of proof at which I conceive the different facts which have been before and since observed leave the question.

On examining the egg of the *Blatta* (which is a compound egg formed somewhat like a broad pea, in which spaces are partitioned off transversely for the reception of the different young insects), we find at an early stage a row of unmistakeable grubs, ten or twelve in number, packed closely up, filling these partitions. I possess a specimen where the grubs have apparently reached their full growth, for they fill the whole space, and are nearly a quarter of an inch in length.

I possess another egg, on opening which I found only two insects, but they had no longer the grub form; they were small, wingless *Blattæ*; one was perfect and fresh, the other somewhat injured; they were probably the last survivors of their brothers and sisters, whom they had no doubt devoured; for the egg, although ready to open, had never given egress to any of its inmates. I am satisfied of this, from the position and condition of the eggs. They were taken from the corners of the eyes and behind the ears of a rude idol-like figure which was sent to me from Africa. When the insect had laid them there, it had plastered them all over with a cemented coating of chopped wood or straw, like a cocoon; and after this had been done, the whole figure had been rudely painted by

the natives, and these cases were covered with the paint. No insect could have emerged without breaking through the case and the paint, which were both uninjured. I presume, at a certain stage on their passage homewards, the cold had killed them, and I found the mummied remains as I have described.

In my former paper on this subject, I think I distinctly showed the existence of a cocoon found in the egg of the leaf insect; and combining these particulars, we have the following chain of facts:—

1. The grub in the egg.
2. A cocoon in the egg, containing the unwinged, imperfectly-developed insect.
3. The unwinged, imperfectly-developed insect in the egg, free from the cocoon, and ready to emerge.

These facts appear to form a pretty secure basis for holding that the course of metamorphosis, in this class of insects, does not differ from that in the other classes, except that the larval stage and pupa stage are passed in the egg, instead of in the open air,—and also probably with this qualification, that the usual changes of skin, which in other insects take place in the larval stage, do not here take place at that period; but, as it would appear, for some reason which we have not yet discovered, that it is essential to the economy of insects that they should cast their skins a certain number of times, the orthopterous and hemipterous insects perform this necessary step after passing from the pupa state, instead of before entering it.

There is another point, bearing upon this question, which I did not sufficiently consider in my former paper. In it I stated that in the leaf insect the sexual organs did not appear to be fully developed until the last change; and I endeavoured to account for this as being analogous to similar changes in other animals on reaching the age of puberty. But I now see reason to modify this expression of my views, or at least to limit this non-development to the younger stages of these individuals, as, for instance, before they have changed their skin at all. In such very young individuals the sexual organs may not be, and probably are not, fully developed; but I am now satisfied that

they are so, at least, before the insect reaches its last and winged state.

I now know, both from personal observation and from the testimony of other observers, that perfect winged Hemiptera have been found coupling with incomplete apterous individuals; and not only so, but two incomplete apterous individuals have been found coupling together.

Such a fact would seem to preclude the necessity of saying more. It looks like *probatio probata*. Notwithstanding this, further light may still be thrown upon it by careful dissections of the sexual organs in fresh specimens of this order of insects in their different stages;—an investigation which I would invite such of my readers as are interested in the subject to undertake, as being likely to lead to discoveries and information of a more extended nature than the mere question now under consideration.

II. *On the Skull of a Seal* (Otaria Gillespii, M'Bain) *from the Gulf of California; with some preliminary observations on the Amphibious Carnivora.* By JAMES M'BAIN, M.D., R.N.

After making some remarks on the Amphibious Carnivora, and narrating a few historical incidents concerning the singularly interesting group of animals to which the skull belonged, Dr M'Bain said, the Amphibious Carnivora—including the walrus and the seals—form a very natural group, which has been designated the “*Phocidæ*.” Formerly all the seals were included under one genus. Buffon first adopted the division into the earless and eared seals; and Pèron, a justly celebrated French naturalist and voyager, proposed the term *Otaria* for those possessed of external ears, whilst the species destitute of an external ear were continued under the old generic title of *Phoca*, or seals proper. Great discrepancy and difference of opinion still exists among zoological writers as to what characters are sufficient to constitute a class, order, family, or genus; and, until the whole series of the animal kingdom has been rigidly investigated, it would be premature to consider the present method of classification as anything more than an approximation to a natural arrangement.

This statement receives considerable support from the manner in which the order *Carnivora* itself has been divided by different authorities, as well as by the various positions assigned to the different genera comprising the order. The external characters of the different members composing the *Carnivora* are sufficiently distinct, and might be supposed to present little difficulty in determining the lesser sub-divisions. This, however, is far from being the case, as the different classifications of authors abundantly testify. It is only of late years that the importance between Morphological, or essential, characters, and those termed Teleological, or adaptive, have been fully recognised as forming a true basis for a scientific classification. Morphological relationship throughout the series of the animal kingdom can only be ascertained by the aid of embryological investigation and comparative anatomy. In any large assemblage of animals, where a general similarity of structure extends throughout the different modifications of form, the difficulty of finding essential characters for the minor sub-divisions will doubtless become much greater and less certain. Conceiving, however, that the natural affinities of the animal kingdom can only be scientifically based on characters truly essential, and independent of adaptive differences, it appears from investigation that the base of the skull is especially furnished with these characters. And in the subsequent remarks on the Amphibious *Carnivora*, and on the skull belonging to the eared section of the order, this portion of the vertebrate skeleton will be chiefly considered. Without entering into details, it will be sufficient at present to state, that Mr Turner has divided the order *Carnivora* into four families,—*Ursidæ*, *Felidæ*, *Canidæ*, and *Phocidæ*,—founded upon essential characters, principally derived from the base of the skull. These characters mainly depend upon the structure and formation of the pterygoid bones and processes, the form of the mastoid and paroccipital processes and tympanic bulla, and on certain foramina for the transmission of nerves and blood-vessels. In applying these characters to the amphibious family of the *Carnivora*, it will be at once apparent, from an examination of two crania, representing the inauriculate and auriculate section of the seals, that they are very distinctly separable.

In the skull of the common seal (*Calocephalus vitulinus*), which represents the inauriculatæ, there is no post-orbital process; the mastoid can scarcely be called a process, and seems to form a part of the large-rounded tympanic bulla. It is separated from the bulla by a distinct groove, extending from the stylomastoid foramen obliquely backwards and inwards. In the section to which the *Calocephalus vitulinus* belongs there is no trace of an ali-sphenoid canal. In the auriculatæ there is a distinct post-orbital process and an ali-sphenoid canal; the mastoid process is largely developed, and stands apart from the tympanic bulla, which is small and projecting. The carotid canal has the same direction as in the Canidæ; while in the common seal it enters farther forward, and does not again appear externally. The orbito-sphenoids are greatly compressed in front, so that the optic foramina seem to have coalesced into one. These osteological characters have afforded a basis for the division of the Phocidæ into three sub-families.

1. *Arctocephalina*.—A post-orbital process; a distinct ali-sphenoid canal; mastoid process strong and salient, its surface continuous with the tympanic bulla. This sub-family contains two genera,—*Otaria* and *Arctocephalus*.

2. *Trichecina*.—No post-orbital process; an ali-sphenoid canal. One genus and one species only known,—*Trichecus Rosmarus* (walrus).

3. *Phocina*.—No post-orbital process; no ali-sphenoid canal; mastoid process swollen, and seeming to form part of the tympanic bulla.

By examining this Californian skull, it will be seen that the osteological characters correspond to those ascribed to the sub-family Arctocephalina. There is a well-developed post-orbital process, and a distinct ali-sphenoid canal. The mastoid is a strong, irregular-shaped process, deeply impressed by the muscles attached to this portion of the cranium. The carotid canal commences directly in front of the *foramen lacerum jugulare*, and again appears at the anterior part of the tympanic bulla. The *foramen condyloideum* is situated at the posterior and inner margin of the *foramen jugulare*; in the common seal it is placed farther back, and directly behind the

foramen. The orbito-sphenoids are so strongly compressed in this specimen that the optic foramina have literally coalesced into one. The posterior palatine foramina are small, and chiefly confined to the palate bones. In *Calocephalus vitulinus* they are entirely formed in the palatine plates of the superior maxillæ. The anterior palatine foramina are much smaller than in the common seal. The palate bone is a little broader behind than in front, deeply notched and rounded. The glenoid cavity is two inches in length, extending directly outwards, and forms a deep, scooped-out space for the articulation of the lower jaw. The malar bones are directed backwards until they approximate the outer edge of the articulate surface. Two lines drawn from these points to the centre of the incisor teeth will form two sides of a triangle, the third side of which will be a line extending directly across the base of the skull. The malar bones in the common seal do not pass so far backwards, and the outline of the zygomatic arch and base of the cranium is of an oval form. A striking peculiarity of this skull, by which it can scarcely fail to be distinguished from any other species, is an elevated sagitto coronal crest, extending in a gradually arched form from the upper edge of a parieto-occipital crest, until it diverges by two slight ridges, and loses itself into the post-orbital processes. This crest is rather more than an inch high in the centre, and indicates the presence of powerful temporal muscles in this species. The nasal process of the superior maxilla reaches as far back as the posterior extremities of the nasal bones. In the common seal the nasal process does not pass so far backwards. This character has been pointed out by Professor Owen as a special osteological distinction between the lion and the tiger, and may therefore be considered a useful one. The nasal bones are separated behind by an acute-pointed triangular process of the frontal bone, forming a double nasal notch, where the nasal bones and nasal processes of the superior maxillæ terminate backwards. There are two very small external processes on the anterior margins of the nasal bones. In the common seal these external processes are well developed and more acute, with two inner ones, smaller, and forming a short triangle. At the anterior and under part of the nasal fossæ,

the premaxillary bones unite into a prominent tuberosity, with lesser tubercles behind, on their inner margins. The nasal aperture is small, and narrower below than above. On the nasal process of the superior maxilla there is a distinct ridge, which may be called the anterior orbital ridge. The inferior maxillary bone is large and strong, with a rounded, obtuse, and greatly-compressed coronoid process. The angular portion of the jaw is flattened, forming two processes, the upper of which is largest, and deflected inwards towards the inner edge of the condyle. The lower jaw is narrow, and rounded below anteriorly, the two bones closing together, and forming a chin.

Osteologically, the common seal has neither chin nor forehead. The teeth are not greatly worn, but the obliteration of many of the cranial sutures would seem to prove that the skull belonged, if not to an old, at least to a full-grown individual. The teeth are thirty-four in number, the formula being, six incisors in the upper jaw and four in the lower,—two canines above, and two below, with five molars on each side of each jaw. The six upper incisors are nearly in a straight line, the two external much the largest, and resembling small canines. The four central are slightly bifid. The canines are large, and succeeded by five molars, about equal in size, with a strong conical tubercle in the centre. There are two minute tubercles anteriorly and posteriorly, with slight callosities surrounding the base of the corona. The molar teeth possess but one root. In the common seal the molars have two roots, and are placed obliquely in the jaws. This last peculiarity was pointed out by Professor Nilsson as characteristic of the species.

The general characters of this skull seem to agree best with the description of the genus *Otaria* given by Dr Gray in the Catalogue of the British Museum for 1850. There is no notice taken, however, of a longitudinal, sagitto-coronal crest in any of the descriptions of this section; nor is it represented in any of the figures of crania. No skulls belonging to the auriculate section of seals, so far as I have been able to ascertain, exist in any of the public collections of Edinburgh. The New College Museum contains two crania

of the *Calocephalus vitulinus*, one of *Halichærus gryphus* (imperfect), and one of the *Pagophilus Groenlandicus*. In the Barcleian Museum of the Royal College of Surgeons, besides a skeleton of *Calocephalus vitulinus*, there is also one of *Halichærus*, a cranium of the same, and two of *P. Groenlandicus*. In addition to these, there is a skull of the *Phoca barbata* in the anatomical collection of the University, along with a skeleton and two skulls of *C. vitulinus*. In the osteological rooms connected with the National Museum of the University there is an interesting skull of a seal, marked "from Southern Africa," that merits a brief notice. The dentition is four cutting teeth in the upper jaw, and two in the lower; two canines in each jaw, and ten molars, equal to thirty, corresponding to the sub-family *Cystophorina*, in the British Museum Catalogue. In that sub-family Dr Gray has included two genera, *Morunga* and *Cystophora*; but this cranium does not well agree with the generic characters ascribed to either of these. At present it will only be necessary to mention the form of the palate bones. In *Morunga*, the hinder palatine bone is stated by Dr Gray to be short and transverse. In *Cystophora* it is said to be broad and square. In the skull belonging to the National Museum, the palate bones form a double notch behind, with two inner processes, forming a distinct triangle in the middle, somewhat similar to the posterior margin of the palate bone in the dog. The nasal bones are greatly expanded behind, becoming suddenly very narrow in front. The general contour of the cranium is round and vaulted, depressed posteriorly over the supra-occipital bone, and with a large internal space for the brain. It measures about nine inches in length at the base, and from the complete separation of the sutures, and general condition of the teeth, it evidently belonged to a young individual of the species. I am indebted for the opportunity of examining this skull to Mr Davis, the assistant conservator, whose obliging disposition, untiring energy in perfecting the arrangement of the national collection, and in making additions where mostly wanted,—viz., to our indigenous fauna,—deserves the highest praise. There are two important characters belonging to the Californian skull, neither of which are mentioned

amongst those of the two genera *Arctocephalus* and *Otaria*; nor are they included in Dr Gray's description of the sub-family *Arctocephalina*. These are, the number of molar teeth on each side of each jaw, and the remarkable longitudinal sagitto-coronal crest, which could not have been overlooked by any zoologist. The dental formula of *Arctocephalina* by Dr Gray is—cutting teeth six above, four below, upper often bifid; grinders, six on each side of each jaw, equal to twenty-four. In this skull the number of molars are five on each side of each jaw, and there is no trace of a nidus for another molar behind. I owe the possession of the skull to my friend Dr John Gillespie of Leith, who obtained it from a sailor just returned from California. The seaman stated, that he had found it at the mouth of the Red River, which we infer to be the Rio Colorado at the head of the gulf.

In the "History of British Quadrupeds," the author remarks, "There is not, I believe, a single group among the whole of the mammiferous class which is at present so indistinctly known, and of which the species are so much confounded, as the seals." This statement, added to the remark of Pèron, "that there really exist more than twenty seals which go under the name of sea-bear," will be a sufficient excuse for giving this description of the skull to the Royal Physical Society. Assuming this to be the skull of the Otary of Stellar, which has already received the synonym of *Otaria Californiana*, it possesses very great interest as one of the "desiderata" requested by Dr Gray in 1850 for the British Museum. And no skull of that species is mentioned in the British Museum catalogue as existing in any of the Continental museums of Europe. Therefore, until this is ascertained, it would be premature to institute a new genus founded upon the difference in dentition, and the remarkable longitudinal sagitto-coronal crest peculiar to this cranium. Trusting, rather, that it may eventually prove to belong to one of the twenty undescribed so-called sea-bears of Pèron, it may, in the meanwhile, very appropriately receive the provisional name of *Otaria Gillespii*.

III. *On the Discovery of BEEKITE and OOLITIC QUARTZ at Durness, Sutherland.* By CHARLES WILLIAM PEACH, Esq., Wick. (Specimens were exhibited.)

At your meeting on the 25th April 1855, a paper of mine was read on "The Discovery of Fossils in the Limestones of Durness," an abstract of which is given at page 23 of your Proceedings for 1854-55. The fossils then exhibited were few and obscure; from being the first ever found there, they caused surprise, and were considered not sufficiently numerous or satisfactory to pronounce decidedly on as to the age of the rocks, &c. Since this discovery others have visited that locality. I also was there in June last for a few hours on duty, and having a very short time to spare, I got hold of more fossils. In consequence of conflicting opinions, I resolved to devote some time to try, if possible, to settle this vexatious question. At present it is not my intention to enter into the particulars of that visit. I commenced at Inchnadamph in Assynt, and so on to Durness, Loch Eriboll, Tongue, &c. It will be sufficient to say in this paper, that at Durness I found splendid fossils, consisting of *Maclurea*, *Ophileta*, *Onoceras*, and *Orthoceras*, with minute *Gasteropods*, *Annelides*, &c., thus adding greatly to the list of genera and species, and, as well, new and wider localities. I met with other things which, connected with the fossils, are so satisfactory to Sir Roderick Murchison, that he has pronounced these West Highland rocks to be *Lower Silurian*.

I now proceed to notice the minerals named at the head of this paper:—

First, The *Beekite*. This was first discovered by the late Dr Beeke, Dean of Bristol, and named after him. He met with it in the Triassic conglomerates, on the shore of Torbay, between Torquay and Goodrington Sand, Paignton, Devon, where hitherto, until the summer of 1857, it had only been found. It incrusts the calcareous stones in these conglomerates, and always on the organisms contained in them, in tubercles, from the size of pins' heads to that of a pea. These are generally surrounded by one or more rings, and by a

series of these tubercles and rings covers the organisms with a chalcedonic crust. The small piece, No. 1, sent with this will show the arrangement. It was kindly sent me from Devonshire by Mr Pengelly, F.G.S., of Torquay, who has made this mineral his particular study, and the subject of two papers to the Royal Geological Society of Cornwall. Having collected this mineral when residing in Devon, I felt, on finding it at Durness, that it was a *true Beekite*. I however thought it right to consult Mr Pengelly, and he fully confirms my opinion. Specimen No. 2 is part of an Orthocerite, from Durness, covered with Beekite, which shows the tubercles and rings, it is from the hill near the manse, and, like the Torbay Beekite, is found only on organisms in calcareous rock, and thus far agrees with the Beekite of Torbay. Since I found the Durness mineral, Mr Arthur Williams of Sidcot, in Somersetshire, has informed Mr Pengelly that he has met with Beekite in the Carboniferous Limestone. It is thus interesting to find that this hitherto rare mineral should be found in new and wide localities, and in rocks so much older.

The Oolitic Quartz I got above the cave of Smo, between Durness and Rispond. It is milk-white, occasionally in small balls and globules, attached to each other without cementing matter in the interstices, much like the roe of a small fish ; the interstices gradually become filled and solid ; when a thin section of this solid part is made and viewed under the microscope, the roe-like grains may be seen, showing all the varieties of the free ones. (See specimens Nos. 3 and 4.) This curious mineral has a twofold interest attaching to it. First, it explains that which once greatly puzzled myself and others. My valued friend, Mr Dick of Thurso, found a small *oolitic pebble* near the base of the Old Red Sandstone at Dunnethhead, a portion of which he gave to me ; this I sent to a lapidary in London to cut into slices for the microscope, and who, on returning it, said, "that the only difference that he could see between it and the Oolite of the secondary rocks was, that it was the hardest Oolite he had ever cut." I send a specimen marked No. 5. The small piece, No. 6, is from my native village Wansford, Northamptonshire, and which I rubbed down for examination and comparison. On finding the Dur-

ness specimens, I said, "Here is the explanation of the Dunnet riddle. The pebble was torn from the Lower Silurian, and travelled *upwards* to the Old Red Sandstone of Dunnethead. Secondly, there is a farther interest attaching to it, associated as it is with the *Maclurea* and other organisms peculiar to the Lower Silurian rocks of America, as mentioned by Sir Roderick Murchison at page 422 of his *Siluria*, and who also says these rocks (American) are "partly oolitic, in other parts quartzose and cherty;" and it is thus very pleasing to find the West Highland rocks not only agreeing in organic remains with those of America, but also in the mineral constituents, both being "partly oolitic, and in other parts quartzose and cherty."

Thus, then, the more we examine even often-examined districts, something new may be turned up; the new, although trifling in itself, may lead to facts of importance which will explain difficult problems and solve puzzling mysteries; and thus I hope that these trifles possess sufficient interest to excuse me for troubling you with this notice. There is a farther interest attaching to them: *both are new to Scotland*; and *one*, the *oolitic quartz*, probably *new to British rocks altogether*; I have not found it mentioned in any geological work, except "Siluria," as quoted in this paper.

Whatever pleasure I may feel in my good fortune in these West Highland discoveries, there is one sad drawback, and a painful regret connected with the presentation of this paper,—that my late valued friend Mr Hugh Miller should be lost to us; for I am sure, had he been spared to be present at the reading of this, he would have hailed with pleasure the onward march of a science which he so much loved and benefited. I hope that you will kindly pardon this allusion to our great loss. It is a tribute I have long felt a wish to pay to the memory of one whom I have long loved, and whose memory I shall ever cherish.

Wednesday, 24th March 1858.—WILLIAM RHIND, Esq., President, in the Chair.

Dr SCHLOSSBERGER, Professor of Chemistry, University of Tübingen, was elected a Foreign Member of the Society.

The Donations to the Library were laid on the Table, and thanks voted to the donors :—

1. Tenth and Eleventh Annual Reports of Board of Regents. Years 1855 and 1856. 2. Publications of Learned Societies and Periodicals in the Library of the Smithsonian Institution, Part. II.—From the **SMITHSONIAN INSTITUTION, U.S.A.** 3. Transactions of the Michigan State Agricultural Society.—From the **SOCIETY**, per the **SMITHSONIAN INSTITUTION, U.S.A.**

The communications read were as follows :—

I. Remarks on Lutraria elliptica (Turton). By **GEORGE LAWSON, Ph.D.**

After alluding to the general distribution of this species of shell, which occurs as a fossil in the Coralline crag, as well as on our coasts in the present day, Dr Lawson mentioned that he had collected the animal in a living state on the east coast of Forfarshire, near the mouth of the Tay, where it is thrown up in immense quantities by strong easterly gales.

II. (1.) On Monoecious Reproduction in Tubularia larynx. By **T. STRETHILL WRIGHT, M.D.** (2.) *Dr Wright exhibited a specimen of the Hydra tuba (Dalyell) throwing off Medusæ. And also the Myrothela artica of Sars.*

(1.) The author described the polyp of this zoophyte. He stated that its reproductive capsules were produced on branches arising from the buccal papilla; female capsules containing ova, and male capsules containing spermatozoa, existing together on the same branches. The capsules were each furnished with four short tentacles, which caused them to resemble young polyps. *T. larynx*, like *T. indivisa*, was viviparous.

(2.) Dr Wright exhibited to the Society the *Hydra tuba* of Sir J. Dalyell undergoing the process of change into medusæ. The specimen brought before the meeting was at least four years old, having been in captivity for that length of time. Within the last week it had become elongated into a fleshy cylinder, which was marked with thirteen transverse striæ. The intervals between the striæ became lobed, and were gradually developed into a chain of medusæ, packed together like a pile of saucers. The upper medusæ of the pile were already free and flapping about in the water. Sars had traced the further development of these medusæ into

Medusa aurita, one of the large jelly-fish of the Firth of Forth. Dr Wright stated that he had discovered very distinct evidence of a chitinous corallum covering the attached portion of *Hydra tuba*, which was readily seen on the specimen placed on the table.

Dr Wright was also enabled, by the kindness of Mr Alder of Newcastle, to place before the Society several rare zoophytes, amongst which was the *Myrothela artica* of Sars. He remarked that the animal was not naked, as described by Gosse, but had a distinct horny corallum; nor were its tentacles wart-shaped; they resembled the tentacles of *Coryne*, except in having sting-cells of smaller size. He stated that, according to Mr Cocks of Falmouth, the young of *Myrothela* was furnished with long processes or *legs*, on which it moved from place to place as its erratic fancy led it. But after some time it forsook its wandering life, cast off its *legs*, developed tentacles, fixed itself to a stone, and devoted itself to the more staid occupations of providing itself with food, producing a family of young ones, and stinging those of its marine neighbours who came into collision with it.

III. *Report of an Expedition undertaken to Explore a Route by Rivers Waini, Barama, and Cuyuni, and the Gold-Fields of Caratal, and thence to the River Orinoco, South America.* By W. R. HOLMES, Esq., and W. H. CAMPBELL, LL.D. Communicated by Professor BALFOUR. (See "Edin. New Phil. Journal, Vol. VIII., No. I., July 1858.")

IV. *On the Spiral Threads of the Helix aspersa.* By JOHN CLELAND, M.D.

The exceedingly complex sexual system of the hermaphrodite gasteropoda has in various of its details furnished the theme of much discussion to comparative anatomists. In *Helix aspersa*, in addition to the other remarkable structures of this system, is one whose occurrence is variable in different species, and of whose functions little has been determined. I allude to the long tubule which courses along the side of the uterus, and opens into the duct of the seminal vesicle just before it falls into the vagina.

Siebold notes that this tubule "is very long, with *Bulimus radiatus*, *Helix arbustorum*, *lactea*, and *vermiculata*; very short, on the other hand, with *Helix pomatia*, *nemoralis*, and *candidissima*; that it is entirely wanting with *Helix fratricum*, *strigella*, and *rhodostoma*.*

* Burnet's Translation of Siebold's Anatomy of the Invertebrata, § 227, note 13.

Last year I fed for some time several individuals of *Helix aspersa*, with the intention of examining the structure of the hermaphrodite gland when it should be in a favourable condition. My attention was then drawn to a remarkable spiral thread seen in all the specimens after coupling, projecting from the female division of the sexual orifice, and trailing along the whole length of the animal's body. Siebold, in his "Anatomy of the Invertebrata," alludes to this thread in a note, and suggests that it is the remains of a spermatophore, and is secreted by the multifid vesicles; but in both these ideas he is decidedly mistaken. However, he refers to two papers on the subject, and in one of these, by Carus, the nature of the structure is perfectly apprehended. Carus saw it in *Helix arbustorum*, and states that it consists of hardened albumen; that he found that it was situated in the long duct of the spermatic vesicle, and that it passed from that to the common genital opening, whence, after coupling, it issued gradually, and was lost, until subsequently renewed. "Worthy of remark," says he, "are two longitudinal folds on the inside of the duct, as well as the diverticulum described by Brandt, whose cavity may supply the first material for the nucleus of the elastic body.*

The observation which I wish to bring under the Society's notice is, that in *Helix aspersa* the long tubule, which is indeed only a greatly developed diverticulum inserted very low down into the seminal duct, is the secretor of this spiral thread. Towards the pairing time the duct gets very much elongated, and at the same time stiffened, by the development of the thread in it, and in consequence it can be no longer alongside of the uterus, but is thrown into convolutions, and so becomes separated from it except at the apex. During coupling the uterus is contracted, and this convolutes the tubule still more, and no doubt aids the expulsion of the thread. The lining membrane of the tube is thrown into folds similar to those which Carus describes in the diverticulum of *Helix arbustorum*.

At the period of greatest development the superior extremity of the tubule, for about half a line, is bent abruptly back upon

the succeeding portion, and there is a small communication with the upper end of the uterus, to which the tube is bound down. This communication affords the explanation of the formation of the spiral thread; for there can scarcely be any doubt that the albumen which hardens to form that structure comes from the albumen gland. This communication was suspected by Meckel, in consequence of that which he had found in *Doris*; but he mistook the object of it, supposing, as he did, that the tubule was a bursa copulatrix, and that the communication was for impregnating the eggs in the uterus.

There can be no doubt, as regards the use of the spiral thread, that Carus was right in supposing it to be for stiffening and dilating the passages; perhaps it may even grasp the intromittent organ of the other animal.

V. *Note on the Cuckoo*, *Cuculus canorus*, Linn. (Pellet found in stomach.) By JOHN ALEX. SMITH, M.D.

On the 20th of last May, Dr Smith dissected a male cuckoo, in full adult plumage, which had been shot in this neighbourhood a day or two before. The stomach, a musculo-membranaceous bag, with the proventriculus well defined, measured two inches in length, and one and a-half inches across or in breadth; it appeared to contain a firm rounded body, lying loosely in its otherwise empty cavity. On opening the stomach, the proventriculus was found filled with a mucous secretion, and a black oval-shaped body was seen, of a smooth and lubricated appearance; it measured one inch in length and about half an inch in breadth, and weighed 31 grains troy. When broken across, it was found to be of a lighter colour, and nearly dry internally, and consisted apparently of the undigested remains of insects and larvæ, portions apparently of elytra, vessels, &c. It was evidently the indigestible parts of the food prepared for being ejected from the stomach by the mouth,—a “pellet” or “cast,” as it has been called, which is so well known in the case of the hawks and owls; and from the abundant secretion in the proventriculus, and empty state of the stomach, was apparently on the very point of being ejected by the mouth. The fact was new to him as regarded the cuckoo, and he therefore noted it with considerable interest. The lining membrane of the stomach showed no appearance, either to the naked eye or to the microscope, of the coating of hair, which has been often described, and which he had seen in other specimens; this coating is believed to be caused by the bird feeding on hairy caterpillars, perhaps at a more advanced period of the season; the intestines contained only a uniform

smooth creamy-like matter. The testes were very small, being scarcely one-fourth of an inch in length, the largest like a very small pea. Several genera of birds, it is well known, eject the indigestible parts of their food as pellets. Sir William Jardine believes, that in addition to the Accipitres, the cuckoos, king-fishers, motmots, and bee-eaters all do so. Macgillivray says,—“ I have never met with a fragment of the elytra, the articulation of a limb, or any other hard part of an insect in the intestines of the cuckoo, the contents of which are of a uniform pulpy and impalpable mass of a light red colour. Of course, the remains of insects in the stomach must be thrown up in pellets as in hawks and owls.” Dr Smith was able, therefore, to supply the positive side of the evidence, and by exhibiting the pellet from the stomach itself, put an end to any doubt that might have existed on the subject, at least in regard to the cuckoo.

Wednesday, 28th April 1858.—ANDREW MURRAY, Esq., President, in the Chair.

Incorporation of the Wernerian Natural History Society with the Royal Physical Society.

[Since the death of Professor Jameson the Wernerian Society had been comparatively inactive, and it was at last resolved by its surviving members, after holding special meetings, which had been summoned by public advertisement in the different newspapers, that it was inexpedient, for various reasons, to resuscitate the Wernerian Natural History Society. It was further resolved, that as the Royal Physical Society had been vigorously cultivating the different branches of Natural Science, while the Botanical Society had taken up the department of Botany; the Wernerian Society be formally dissolved; and that its funds be divided between these two Societies, in the proportion of two-thirds to the Royal Physical Society, and one-third to the Botanical Society. The books on botanical subjects being given to the Botanical Society, and the remainder (with certain exceptions) to the Royal Physical Society.

It was also arranged that all Members of the Wernerian Society be admitted to the membership of these Societies without the payment of any entrance fees, and with all the privi-

leges retained, which, as Life Members or otherwise, they might have previously been entitled to enjoy.]

The conclusion of the arrangements between this Society and the Wernerian Society was now reported, and statements were made by Mr Oliphant the Treasurer, and Mr R. F. Logan the Librarian, as to the amount of money and books received by them. The following list of Members of the Wernerian Society was laid on the table, and the Society congratulated itself on this addition to the roll of its membership, and on the whole arrangements relative to the incorporation of the two Societies. Thanks were voted to the gentlemen by whose good offices this favourable termination had been arrived at.

The Members of the Wernerian Society have been added to the roll of the Royal Physical Society as follows :—

MEMBERS OF THE WERNERIAN SOCIETY,

(So far as known, with the date of their Election.)

1. Resident Members.

ALEXANDER MONRO, M.D., Craiglockhart, late Professor of Anatomy, 12th January 1811.

Sir ARTHUR NICOLSON, Bart., 30th March 1816.

ALEXANDER JAMES ADIE, Esq., Canaan Cottage, 7th December 1816.

GEORGE BERRY, Esq., Rosefield, Portobello (Life Member), 18th April 1818.

PATRICK SMALL KEIR, Esq. of Kindrogan, 18th April 1818.

*WILLIAM MACDONALD, Esq., Professor of Civil History, St Andrews, 5th Dec. 1818.

PRIDEAUX JOHN SELBY, Esq. of Twisel, 15th April 1819.

*ROBERT KAYE GREVILLE, LL.D., 33 George Square, 15th April 1819.

Sir ANDREW SMITH, K.C.B., 15th April 1819.

Dr THOMAS STEWART TRAILL, Professor of Medical Jurisprudence, April 1819.

*JOHN DEUCHAR, Esq., Morningside House (Life Member), 29th Dec. 1819.

Sir WILLIAM JARDINE, Bart., Jardine Hall, 2d December 1820.

ROBERT EDMOND GRANT, M.D., Professor of Comparative Anatomy, University College, London, 21st April 1821.

*ROBERT KNOX, M.D., London, 21st April 1821.

ADAM GIB ELLIS, Esq., W.S., 4 Royal Terrace, 1st December 1821.

ROBERT HAMILTON, M.D., Sciennes House, 20th April 1822.

*GEORGE A. WALKER-ARNOTT, LL.D., Professor of Botany, Glasgow, 30th November 1822.

JAMES SYME, Esq., Professor of Clinical Surgery, 3d April 1824.
 JOHN GEDDES, Esq., Mining Engineer, 5th April 1826.
 GEORGE LEES, LL.D., 5th April 1826.
 Rev. JOHN GIBSON M'VICAR, Moffat, 19th April 1828.
 *JOHN COLDSTREAM, M.D., 51 York Place, 9th January 1830.
 ROBERT PATERSON, M.D., 32 Charlotte Street, Leith, 3d December 1836.
 JAMES SMITH, Esq. of Jordanhill, 21st January 1837.
 DAVID MILNE HOME, Esq. of Milnegraden, 10 York Place, 18th April 1840.
 *JOHN GOODSR, Esq., F.R.S., Professor of Anatomy, 29th November 1840.
 *JOHN HUTTON BALFOUR, A.M., M.D., Professor of Medicine and Botany, 28th March 1846.

2. *Non-Resident Members.*

Sir WM. JACKSON HOOKER, K.H., Director of Royal Gardens, Kew, 4th November 1809.
 ROBERT BALD, Esq., Mining Engineer, Alloa, 7th April 1810.
 WILLIAM BORRER, Esq., F.L.S., Sussex, 1811.
 *Sir WALTER CALVERLEY TREVELYAN, Bart. of Wallington, Northumberland, 29th December 1819.
 General Sir THOMAS MAKDOUGALL BRISBANE, G.C.B., G.C.H., Pres. R.S.E., 1st December 1821.
 Sir JOHN RICHARDSON, C.B., 26th November 1822.
 GEORGE BENTHAM, Esq., F.L.S., 13th January 1827.
 Captain HENRY DRUMMOND, H.E.I.C.S., 3d December 1836.
 ROBERT ALEXANDER MAINGY, Esq., Mining Engineer, 28th March 1846.
 GEORGE BUIST, LL.D., Bombay, 28th March 1846.

3. *Corresponding Members.*

JOHN TORREY, M.D., New York, 19th April 1823.
 JOSEPH MITCHELL, Esq., Superintendent of Parliamentary Roads, 5th February 1825.
 LAURENCE EDMONSTON, Esq., Surgeon, Shetland, 30th November 1832.
 Rev. JAMES DUNCAN, Denholm, 14th December 1832.
 Rev. JOHN ANDERSON, D.D., Newburgh, 11th August 1838.
 DAVID MUSHET, Esq., Mining Engineer, Gloucestershire, 18th April 1840.
 JOHN MACLELLAND, M.D., Calcutta, 29th November 1840.

4. *Foreign Members.*

ALEX. BARON VON HUMBOLDT, 12th January 1808.
 ALPHONSE DE BREBISSON, 3d May 1817.
 ADOLPHE BRONGNIART, M.D., Professor of Botany, Paris, 19th April 1823.

N.B.—Those marked with an asterisk are already Fellows of the Royal Physical Society.

The Report of the Committee on Marine Zoology, including a detailed account of the dredging apparatus belonging to the

Society, was read by the Convener, George Logan, Esq., W.S.; and unanimously approved of.

The usual Committees were appointed for conducting special investigations during the recess.

Museum of the late Hugh Miller.—The Secretary, Dr J. A. Smith, stated that a public subscription had been commenced to purchase the museum of their late President, Hugh Miller, for the purpose of its being placed in the National Museum about to be built in Edinburgh; he alluded to the importance of preserving unimpaired such a valuable collection, and the advantage to be derived by all students of geology in being able, in any future examination of fossils, to refer to and examine the original specimens described by Hugh Miller himself in his various published works. Lists of the members of the Society who had already subscribed were laid on the table, and the Secretary said he would be glad to be favoured with the names of others who might be anxious to lend their aid to the completion of so desirable an object.

The following Donation to the Library was laid on the Table, and thanks voted to the donor:—

The Canadian Journal of Industry, Science, and Art, No. XIV. From the CANADIAN INSTITUTE, Toronto.

The following Communications were read:—

I. *Notice of Coal found in the Argillaceous Slate Quarries of Seil Island, Argyleshire.* (Specimens were exhibited.) By WILLIAM RHIND, Esq.

The island of Seil, and the adjoining isle of Eisdale, lying close to the Argyleshire shore, and six miles south of the village of Oban, belong to the group called by Dr Macculloch the "Slate Isles." They are composed chiefly of fine-grained argillaceous schists, occasionally alternating with which are layers of a coarser-grained schist, termed by Dr Macculloch "greywacke," and also thin strata of a dark-grey slaty limestone.

The isle of Seil, which is about three miles in length by two in breadth, is described by this geologist as consisting of beds of argillaceous schist, with a bearing N.E. by N., and a dip to E. On the north-west is an elevation of trap-rocks, of the same kind as prevails throughout the large island of Mull, the surrounding smaller isles, and the mainland of Lorn, Argyleshire. The argillaceous schist occupies the middle and greater portion of Seil; and towards the east is succeeded by a grayish stratified rock, which is composed of a conglomerate of felspathic and hornblende rocks; to this, again, succeeds the same argillaceous strata as in the centre. On the north-west point of the island is a patch of red sandstone, similar to that which prevails in Kerrera and the Mainland. The small isle of Eisdale consists of the same roofing-slates as those of Seil. In March of the present year (1858), while the quarrymen were at work in the slate quarry in the centre of Seil, about 140 feet below the surface, on turning up a large block of limestone, which had previously been detached by blasting with gunpowder, they noticed a sort of break or crevice in the rock, and a slight coating of unctuous clay all around it. A detached mass from the crevice, of a few inches in length, excited their curiosity from its lightness; and on washing it, they perceived that it was a coaly mass. Such are the words of a statement by the intelligent superintendent of the quarries, Mr Whyte, to whom, on his arrival at the spot, the workmen delivered the coaly matter, and pointed out to him the place where it had been found.

Specimens of the clay-slate, limestone, and coal, were sent to me through Dr Thomson, the medical gentleman resident on the island. The schist is the common small-grained roofing-slate described by Dr Macculloch. The greyish limestone, which freely effervesces in hydrochloric acid, appears also identical with the "grey limestone slate" of this geologist. The coal has all the external appearance of ordinary glance-coal; it burns with a bright flame, and leaves a cinder. Under the microscopical manipulation of Mr Bryson, it distinctly indicates a "vegetable cellular structure, resembling the *fucoid* forms of vegetation." The presence of distinctly vegetable matter, having all the properties and appearances of coal,

has thus been identified in the argillaceous schists of Argyleshire, where hitherto no traces of organic remains have been discovered. Whether this coal, in geological position, belongs to the so-called primary argillaceous schists, or to the grey limestone, or the "coarser-grained graywacke," which appears to alternate with this schist, it would be difficult, from the report of the finders, exactly to determine; but still, to whichever of them it may, by subsequent and more careful discovery of specimens, be appropriated, it must still form an interesting link in the history of organic life, as connected with the azoic, or, at all events, the lowest beds of the palæozoic strata. Supposing the grey limestone and coarser-grained schist to be the lowest beds of the Silurian strata, interstratifying with the upper beds of the azoic slates, it proves what, indeed, *à priori* reasoning must have indicated, that vegetable forms must have preceded the very oldest and lowest classes of animal life; for as no animal, even the most simple, can derive direct nourishment from the mineral kingdom alone, so the existence of animal life presupposes the existence of vegetable.

[Since this notice was read, the locality has been visited and inspected by Professor Nicol of Aberdeen. He traced a line of crack or fissure extending from the place where the coal was found, up towards the surface, indicating, as he supposes, a separation of the continuity of the strata at this point during some convulsive movement posterior to the original deposition of the clay slate. Into this fissure he conjectures the piece of coal may have been insinuated and afterwards closed up. The absence of all traces of coal, or the carboniferous formation, in the wide surrounding districts, and the improbability of the supposed convulsion having occurred during so recent a period as the working of the quarries by man, still leaves the explanation of the appearance of the coal — of the true nature of which there seems no doubt — a geological mystery.]

II. *Remarks on a Baleen Whale captured off the Bell Rock on the 7th of September 1857.* By JAMES M'BAIN, M.D., R.N.

Dr M'Bain began by stating that the history of the fin-

baleen whale, to which the subsequent remarks applied, was briefly as follows:—When passing near the Bell Rock, on the 7th of last September, the crew of a yacht, named the Spray, observed a large animal floating on the water, apparently dead or in a dying condition. They obtained permission to have it taken on board the vessel, and brought to Leith, when it afterwards became the property of a merchant there. This animal was exhibited to the public for nearly a week, until the process of decomposition having commenced, necessarily put a stop to this proceeding.

During the period it was thus publicly exposed to view, a favourable opportunity was afforded for taking measurements, and noting the external characters of the animal. And, fortunately, the great care and attention bestowed by those connected with its capture and removal had kept it in so excellent a state of preservation, that there was scarcely a scratch to be seen on the outer surface. The length of the animal, following the curve of the back, from the snout to the extreme margin of the centre of the tail, was 14 feet 5 inches; the circumference, at the fore part of the pectoral fins, 8 feet 4 inches; from the snout to the dorsal fin, 9 feet 3 inches, or nearly two-thirds the length of the animal; from the snout to the pectoral fins, 4 feet 9 inches, exactly one-third the total length; length of the pectoral fin, 1 foot 7 inches, or one-ninth the whole length. The dorsal fin was falcate-shaped, curving backwards, $11\frac{1}{2}$ inches in height in the line of the curve, and 8 inches long at the base. From the posterior edge of the dorsal fin to the end of the tail, 4 feet 6 inches. The greatest breadth of the tail was 3 feet $8\frac{1}{2}$ inches. The colour of the animal above was glossy black, extending half way down the sides. Beneath white, with a delicate rose-pink, which, taken along with the general symmetry, gave to it a positive appearance of beauty. From 60 to 70 deep longitudinal folds, less than an inch broad, extended from the posterior margin of the under lip along the chest and greater part of the abdomen, the longest measuring 8 feet 7 inches. Several stiff bristles were situated at the end of the snout in each jaw, the lower jaw projecting an inch or two beyond the upper. The two rows of baleen plates in the upper jaw were of a

whitish-brown colour, the laminæ 2 inches broad, placed close together, smooth and concave externally, and shelving off from their inner edge. The longest, about 5 inches, were placed at the posterior half of the jaw, the two rows curved backwards and inwards towards each other before the entrance to the oesophagus, becoming gradually shorter as they advanced forwards to the anterior part of the upper jaw. These plates were fringed on their inner margins with hair of a like colour hanging about an inch beyond their free extremities. This animal was a male.

The external characters and measurements agreed with the descriptions given of the *Lesser Rorqual*, the *Balaenoptera Rostrata* of the British Museum Catalogue for 1850. With the exception of a yellowish-red colour given to the baleen, and a too strongly marked line of distinction between the black and white on the outer part of the pectoral fins (which are also too long proportionally), the figure of Dr Knox's *Rorqualus minor*, in Sir Wm. Jardine's "Naturalists' Library," exhibits a very fair representation of the appearance this specimen presented. The tongue, of enormous size, rose up from the under surface of the mouth, nearly filling the whole interior, and extended backwards in the form of a great, thick, fleshy cushion, with a free portion projecting from the fore and upper part about a foot or more. The lateral edges adhered to the sides of the mouth, admitting only of a very limited motion, the enlargement of the mouth appearing to depend upon the dilatile extension of the external skin and longitudinal plicæ. In the mouth and tongue decomposition began to manifest itself about the fourth or fifth day.

The spirited proprietor, Mr Laird, decided on having so perfect a specimen preserved to science, if a taxidermist could be found to undertake the task. This was most successfully accomplished by Mr Sanderson, of George Street, Edinburgh, and his assistant, Mr James Keddie, after a great amount of labour, occupying several weeks. And it is to these able workmen that we now owe the permanent preservation of the external characters of a fin-baleen whale, nearly 15 feet long, with the baleen plates complete, and in their natural position.

The late lamented Dr John Fleming, Professor of Natural Science in the New College of Edinburgh, took a great interest in this specimen, as he did in every object of investigation that tended to the advancement of science. He expressed a wish that, if an opportunity occurred, Dr M'Bain would repeat the observations of Dr Robert Knox as to the number of the vertebræ and ribs found by that anatomist in the Lesser Rorqual, obtained at Queensferry in 1834. This task, owing to the obliging liberality of the proprietor, had been fully carried out. With the exception of the skull, retained in the preserved specimen, the other bones composing the skeleton had been kept, and were now in his possession. Owing to circumstances which could not be avoided, the dissection took place chiefly by candle light, and was consequently rough and hurried. Many portions of the internal organization—the heart, kidneys, and renal capsules, for instance—put aside until the process was completed, and intended for future examination, were feloniously abstracted by canine or feline visitors. The occurrence of the dissection under such conditions was a source of much regret, as several anatomical points of great interest are still wanting in reference to the baleen whales; for example, the extent, connection, and function of a so-called pharyngeal pouch beneath the tongue. On cutting into this huge fleshy mass, a large cavity was found, from which air issued freely. This was lined by a very delicate membrane, and there appeared to be more than one of these cavities; but there was no time to ascertain their character or connection. They seem to be simply what has been conjectured,—merely inflated portions of the areolar tissue, from commencing decomposition, but certainly not the distended stomach pushed up into this region, as suggested by M. F. Cuvier in his article on the Cetacea, in the Cyclopædia of Anatomy and Physiology. On removing the tongue, a great vascular net-work was observed, spreading out between the two branches of the lower jaw. This appeared to be a continuation of that remarkable arterial plexus first observed by John Hunter in a “piked whale,” and partly described by him in the Philosophical Transactions for 1787. Dr M'Bain said, this structure had been afterwards examined, and traced into

the medulla spinalis and interior of the skull, by his former distinguished teachers of anatomy, Drs John Barclay and Robert Knox. The latter, in his account of the *Rorquals Minor*, says, "it is a mass of vascular tissue, closely resembling the erectile, which filled a very large proportion of the interior of the cranium." As a precisely similar mechanism was observed in the throat of the Bell Rock whale when the tongue was removed, it is probable that this great plexus will be found to anastomose with branches of the external carotid arteries. The manner in which the blood is transmitted to this arterial plexiform system, and the force by which it is effected, still remains to be discovered.

In the stomach, which consisted of five distinct parts—the first and second the largest—a considerable quantity of pulvaceous matter was found, with bodies of the vertebræ and bones of the herring intermingled throughout the mass. These were the only organic remains that could be depended on as indicating the kind of food on which the animal subsisted.

An opportunity was afforded for examining the cranium before it was put up in the preserved specimen. A general description of the several bones composing the skull and the foramina was given, illustrated by diagrams. The Bulla Ossea, with the tympanic process and petrous bone, were minutely described, as, from the tympanic bullæ of the whale being frequently found in a fossil state, the minute characters of this bone are deserving of attention, to obtain, if possible, specific or generic distinctions. The bones of the skull were united, either by broadly overlapping, or by deep squamous plates dovetailing into each other, and could be readily separated. A cartilaginous ring, half an inch thick, was interposed between the basi-occipital and basi-sphenoid. The number of the vertebræ amounted altogether to 48, viz., 7 cervical, 11 dorsal, corresponding to the 11 pair of ribs, and 30 beyond, including lumbar, sacral, and caudal. Comparing this formula with seven examples of fin-whales, in which the numbers of the vertebræ had been given in "Bell's History of British Quadrupeds," and in the British Museum Catalogue, and likewise with two Rorquals, a male and female, 50 feet long, captured in Orkney in 1856, careful measurements and observa-

tions of which had been made by a highly intelligent and accomplished naturalist, Mr Robert Heddle, now in Canada; Dr M'Bain said that this formula only agreed with that given by Dr Robert Knox, in his description of the *Rorqualus Minor*, obtained at Queensferry in February 1834, the skeleton of which is now in the University of Edinburgh. In neither of these examples are the second and third cervical vertebræ united by the spinous process, so that this osteological generic distinction of Dr Gray is not a constant character, and cannot be depended on. It is probable that a closer investigation of the structure of the base of the skull might furnish better generic characters for separating these animals, as being more certain and permanent than those derived from adaptive differences, more especially when these latter are founded upon single characters. The atlas, in this specimen, is $2\frac{1}{2}$ inches broader than long. The central hole is half as high again as broad. The second and third cervical vertebræ are not united together by the upper edge. The second cervical vertebra has a broad, much-expanded, lateral process, with a round central hole near the body of the vertebra, reaching rather less than half its length. The 3d, 4th, 5th, and 6th cervical vertebræ have two, or upper and lower, lateral processes. The upper nearly equal in length, shorter, narrower, and thinner, than the 2d and 7th. The lower lateral process of the second cervical vertebra, equal in size to the upper, approximating at the ends, and nearly forming a ring, approaching nearest on the right side. The upper and lower lateral processes of the 3d, 4th, 5th, and 6th cervical vertebræ far apart, the basal portion of the lower becoming shorter, the anterior part pointed upwards, beaked, and increasing in length from 3d to 6th. The upper lateral process of the 7th cervical vertebra resembles the first dorsal in form, but is smaller; the lower process is reduced to a tubercle. The Prozygapophyses are far apart in the cervical vertebræ, increasing in size from 5th, and gradually approaching as they recede backwards along the spinal column.

Omitting for the present other remarks on the remaining vertebræ, ribs, and pectoral extremities, before concluding, Dr M'Bain said, it may not be amiss to remind those inter-

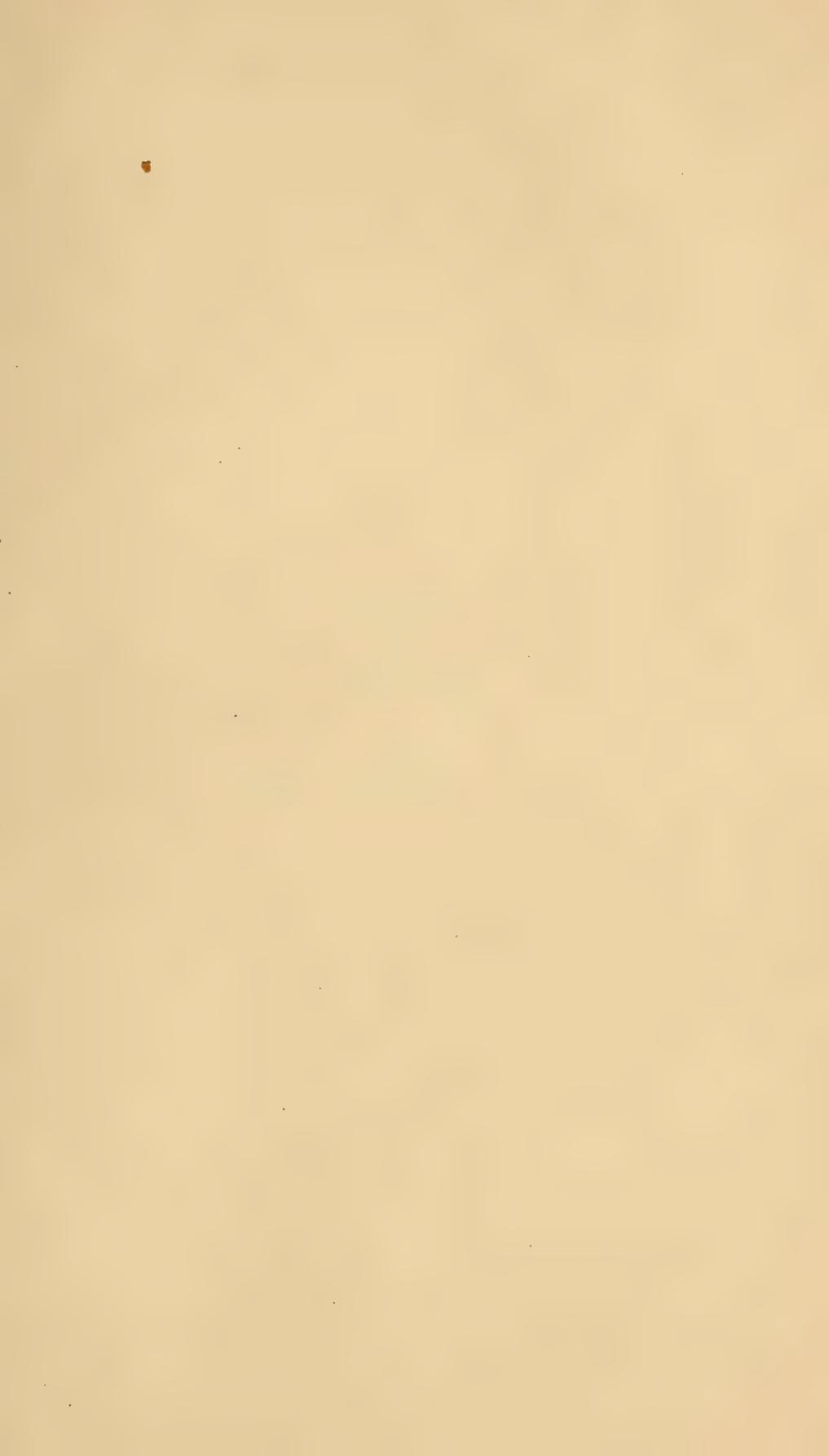
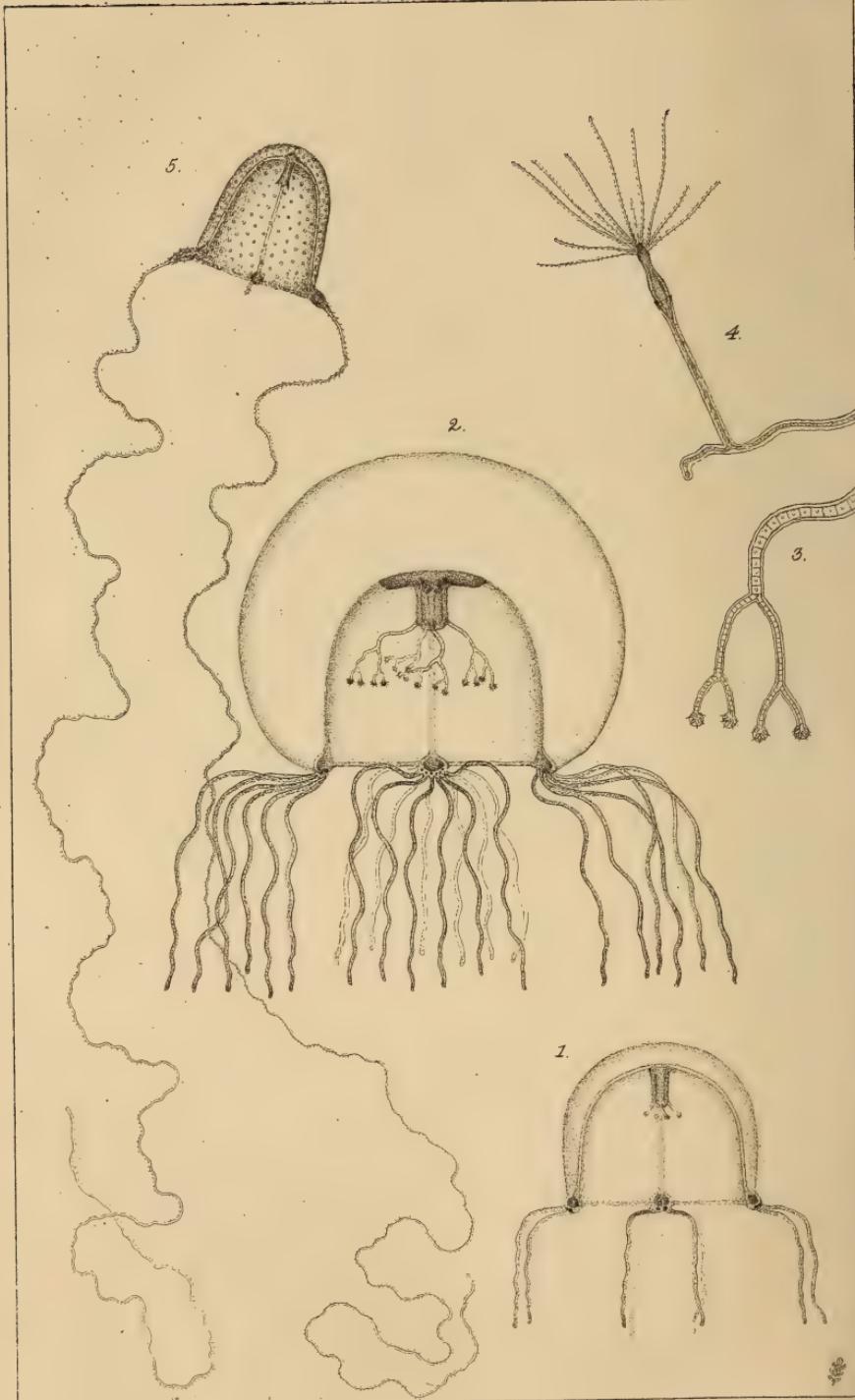


PLATE XXII.

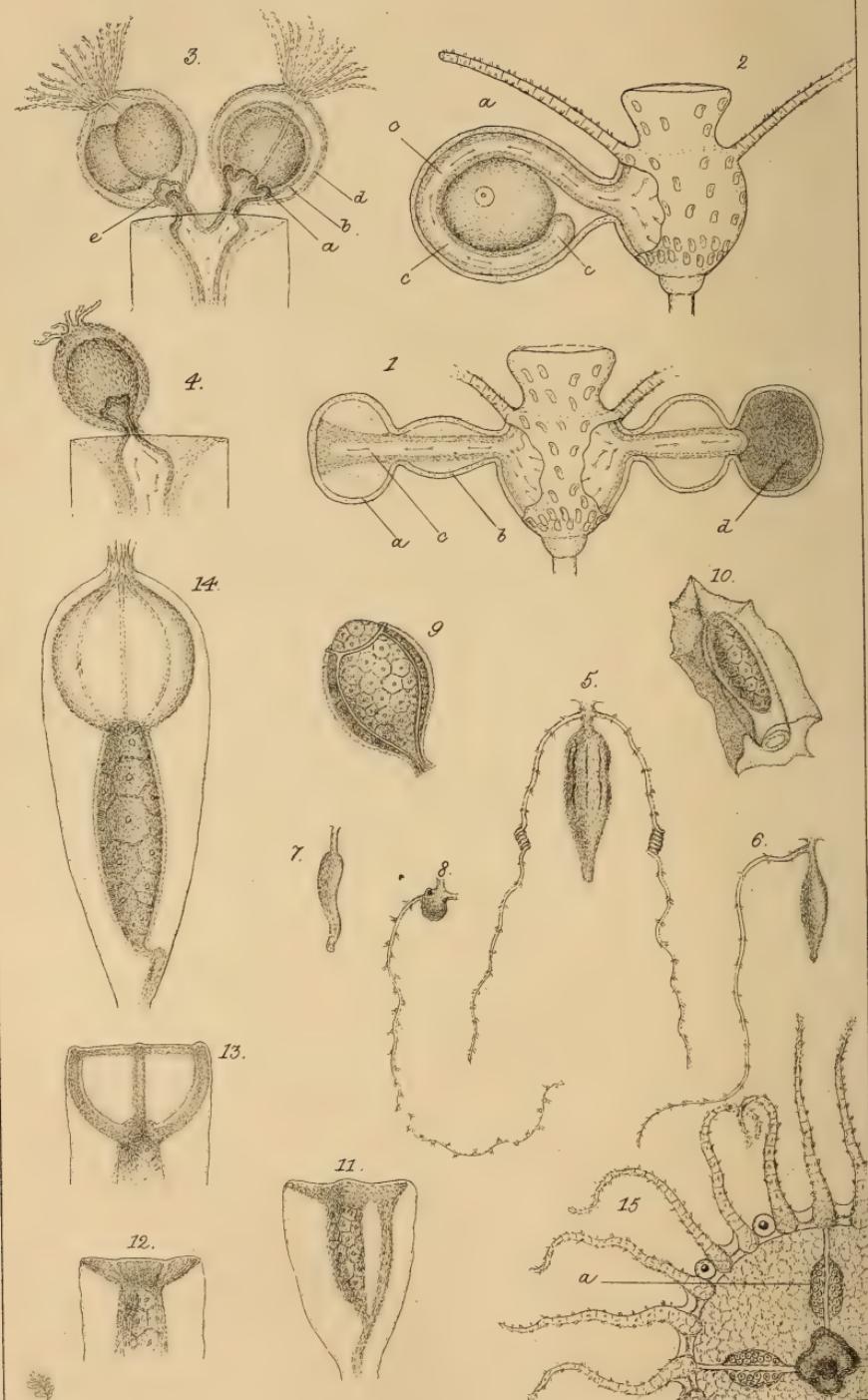
Royal Physical Society. Edinburgh.



I. Strehill Wright, etched on stone.

W.H.M^o Farlane Lith Edin.

Atractylis.



rested in the pursuit of natural history, that it is rare for an animal of this magnitude to be brought within the reach of investigation; and still more so to have an opportunity of adding a specimen, with all the external characters complete, to a national collection. He would therefore suggest, that means should be taken for ultimately securing to the National Museum in the University of Edinburgh the well-preserved specimen of this Bell Rock whale, now in possession of Mr Laird, 22 Constitution Street, Leith.

III. *Observations on British Zoophytes*.—(1.) *On Atractylis* (new genus); (2.) *On the fixed Medusoids of Laomedea dichotoma* (living specimens were exhibited); (3.) *On the Reproductive Organs of the Medusoid of Laomedea geniculata*; (4.) *On the Reproductive Organs of Laomedea lacerata*. By T. STRETHILL WRIGHT, M.D.

Description of Plates.

PLATE XXII.

Atractylis and Eudendrium.

Fig. 1. Medusoid of *Atractylis ramosa*.

2. Same at third month developed into *Bougainvillea Britannica*.
3. Tentacle of peduncle of do. further enlarged.
4. *Atractylis repens*.
5. Medusoid of do.

PLATE XXIII.

Fig. 1. Male polyp of *E. rameum* with double sperm sacs—*a, b*, ectoderm of unripe sperm sacs—*c*, process of endoderm—*d*, ripe sperm sac with spermatozoa; endoderm absorbed.

2. Female polyp of *E. rameum*—*a*, ovarian sac containing single ovum surrounded by *c, c*, process of endoderm.

On Atractylis (new genus).

On a former occasion I read to the Society a description of two Hydrozoan Zoophytes, which I placed in the genus *Eudendrium*, on account of the similarity which their polyps bore to those of the *Eudendrium ramosum* of Van Beneden ("Memoirs of Brussels Academy, vol. xvii., Plate IV."), the *Tubularia ramosa* of Dalyell, although at that time I doubted, with Johnston ("British Zoophytes," vol. i. p. 47), whether Van Beneden's zoophyte did not belong to a distinct genus. Since

the publication of my paper, I have received the opinion of two of our most eminent authors, that my zoophytes were not *Eudendria*, and have been requested to place them in a new genus. The *Eudendrium ramosum* of Van Beneden, and *Eudendria repens*, and *sessile*, described by myself, differ from the *Eudendrium ramosum* of Johnston, in having their polyps destitute of the cup-shaped proboscis, the body fusiform instead of globular, and in the absence of the very large and distinctive thread-cells which occur on the body and within the polypary of *Eudendrium*. I can discover no other permanent difference between *Eudendrium* and *Atractylis* ($\alpha\tau\gamma\alpha\kappa\tau\lambda\varsigma$, from $\alpha\tau\gamma\alpha\kappa\tau\varsigma$, a spindle), as I propose to call the first-named zoophytes. It is true, that nothing can be more dissimilar than the large-branched *Eudendria rameum* and *ramosum*, with their globular bodies, opaque from the excessive deposit of red granules in the endoderm, and the delicate polyps of the smaller species of *Atractylis*; but I have on more than one occasion observed an equally minute creeping species of *Eudendrium*, which could only be identified as belonging to the latter genus by the shape of its proboscis and thread-cells.

The last systematic writer on zoophytes, Mr Gosse, describes *Eudendrium* as "Inclosed; Corallum fibrous, rooted, erect, branching; Polyps protruding from tips of the branches, not retractile." This description is, however, incorrect and insufficient, as it does not notice the proboscis, and, moreover, *Eudendrium* is not uniformly erect or branched. The reproductive system is also unnoticed. The following description will, I believe, give the characters of the genus:—

Eudendrium.—Polypary sheathed, creeping, or erect and branched. Polyps not retractile, globular, fleshy, with an alternating row of numerous filiform tentacles; proboscis cup-shaped, fleshy; endoderm of body dark; thread-cells on tentacles minute, on body large, bean-shaped, containing simple style apparent. Dioecious. Ovaries single sacs, developed from polyps or polypary. Spermaries arranged in moniliform series on pedicles, which arise beneath tentacles of polyps, or on separate stalks from the polypary.*

* Note on the reproduction of *E. rameum*.—Mr Alder, in his "Catalogue of Zoophytes of Northumberland and Durham," says, "According to Sir J. Dalyell the reproductive capsules of this species are of two kinds (probably sperm and

The characters of *Atractylis* are :—

Atractylis.—Polypary sheathed, creeping, erect, or branched. Polyps fusiform, incompletely retractile, with transparent filiform, alternating tentacles (mouth closed by a dense muscular ring). Thread-cells inconspicuous. Reproduction by medusoids.

Atractylis ramosa (Van Beneden, Dalyell).—Polypary sheathed, erect, and branching; stem composed of many minute sub-parallel tubes; ends of branches dilated. Medusoids springing from branches and polyps; umbrella sub-globose; peduncle with four undivided capitate tentacles; marginal tentacles eight, in four pairs, each pair springing from a bulb having two eye-specks; auditory sacs absent.*

ovicapsules). Those I have met with form a cluster round the base of the tentacles, and are arranged in a linear or moniliform series, two or three on each pedicle." *The double sperm sac* consists of two ectodermic sacs placed end to end (Plate II., fig. 1, *a*, *b*), permeated by a tubular process of endoderm (*c*), and containing the spermatic gelatinous plasma. As the spermatozoa first ripen in the distal sac (*d*), the endoderm in that sac is absorbed and withdrawn. The same process afterwards takes place in the proximal sac (*e*). *The ovarian sac* (fig. 2, *a*), contains a single yellow ovum (*b*), which at an early stage is encircled by a looped tubular process of the endoderm (*c*); subsequently this loop is absorbed, and the ovum becomes a ciliated larva filling the sac. Its further change has been described by Dalyell.

* *Note on the development of Bourgainvillea Britannica from Atractylis ramosa*.—In August last I found *Atractylis ramosa* growing in great profusion on the Bimer Rock and on Inchgarvie, both near Queensferry, Firth of Forth. When taken, the specimens were in high condition, each branchlet possessing its terminal polyp; but after being kept in one of my tanks for a few days, I found that a great change had taken place; the polyps were all absorbed, or undergoing the process of absorption, and in their place, and also from the branches themselves, a great number of medusa buds were put forth, which were rapidly developed into the *Medusa ocilia* of Dalyell. The zoophyte had in fact assumed its reproductive phase. It had changed from a creeping hydra-bearing zoophyte, to a multitude of free and actively swimming medusæ. It is well known that the *Aphis*, as long as its pasture is good and the weather is fine, will produce a continued succession of wingless and sexless individuals by internal gemmation. It will continue its phase of nutrition. But should its circumstances fall adverse—should Flora and Jove become unpropitious—then it undergoes its last change, and becomes a winged and egg-bearing creature. It assumes its phase of reproduction. So the glutinous caterpillar, taken yet unsatisfied from his cabbage leaf and shut up in a box, becomes prematurely a chrysalis. And so, too, the medusa-bearing zoophytes, exchanging the open sea for the confined water and poor fare of a tank, become, so to speak, winged medusæ, and, instead of a continued succession of polyps, produce eggs.

The medusa of *Atractylis ramosa*, when first given off from the zoophyte, is identical with the *Medusa ocilia* of Dalyell. The orange-coloured alimentary

Atractylis repens (mihi).—Polypary creeping, sheathed; polyp-stalks erect, single, or bifurcate (wrinkled); ends of stalks dilated or not. Medusoids springing from polyp stalks, mitre-shaped; peduncle quadrangular; tentacles four, two very long, two rudimentary. Eye-spots and auditory sacs absent.

Atractylis sessilis (mihi).—Polyps sessile on creeping polypary, or scarcely stalked, sheathed up to the tentacles. Medusoids developed from creeping fibre, similar in shape to those of *Atractylis repens*.

On the fixed Medusoids of Laomedea dichotoma.

Description of Plate.

PLATE XXIII.

Fig. 3. Summit of reproductive capsule (female) of *L. dichotoma*—*a*, four-lobed endodermal or nutritive process of ovarian sac—*b*, ectoderm of do.—*d*, umbrella or marsupium—*e*, ectoderm of ovary ruptured, ova having escaped into the cavity of the marsupium.
 4. Summit of male reproductive capsule of *L. dichotoma*.
 5. Alimentary polyp of Siphonophorous Zoophyte (*Agalmopsis punctata*), and
 6. Tentacular polyp of same, compared with
 7 and 8. The same organs in *Sarsia*.

polyp or peduncle has four unbranched tentacles, capitate at their extremities with bundles of thread-cells. The orange tentacular polyps are each furnished with two tentacles, and a black eye-speck at the root of each tentacle. In this stage a large number, then about a month old, were brought to Edinburgh. They fed on the minute Entomostracea (which swarmed in the tank), with avidity, and increased in size. But, to my surprise, I found that a further development was taking place in them. The tentacles of the alimentary polyp (peduncle) became first once, and afterwards twice, dichotomously divided, and each of the tentacular polyps put forth additional successive tentacles, until the greatest number observed amounted to six, each additional tentacle being accompanied by an additional eye-speck at its root. At the same time, genital lobes were developed, springing from the peduncle, which passed for a short distance along the lateral canals of the sub-umbrella, and ultimately contained spermatozoa. In other specimens, given off by *Atractylis ramosa* in the spring, but which never arrived at so late a stage of development, ova were found situated in four masses within the walls of the peduncle. This medusa, at its latest stage of development observed by me, bears a strong resemblance to the *Hippocrene* or *Bourgainvillea cruciata* of Forbes, and also to his *Bourgainvillea Britannica*, which I am disposed to consider as different sexes and stages of development of the same medusa. I am the more emboldened to hold this opinion, as Professor E. Forbes has already considered the *Medusa duodecilia* of Dalyell (which represents, as I have observed, one of the stages of that I am now describing) the same with his *Bourgainvillea Britannica*. (*Monograph of British Naked-eyed Medusæ*, p. 68.)—Nov. 22, 1858.

9. False medusoid (ovary with rudimentary umbrella) of *Hippopodius Neapolitanus* (Kölliker).
10. False free medusoid of *Diphyes* (Huxley).
- 11, 12, 13, 14. Development of false medusoid or marsupium in *Sertularia fallax*.

Under the title of *Laomedea dichotoma*, Johnston has described as varieties two very distinct zoophytes. One (the Sea-thread Coralline, *Ellis*, Corall. 21, No. 18, Plate XII., fig. *a*, A), a magnificent production, attains a height of twenty-four inches, its slender stem and branches hidden by thousands of snowy polyps, the whole forming a pyramidal mass, which sways to and fro with every movement of the waves; while from the axillæ of the branches the reproductive cells pour forth shoals of flapping medusoids, which fill the water around with a cloud of living beings. Many of these beautiful trees are joined together by anastomosing lines of creeping fibres, which wander over the rocks, and unite them as a single living being. The other variety (*the Sea-thread Coralline* of *Ellis*, plate xxxviii.) is very different from the last. It is a shrubby Zoophyte, of robust habit, the imperfect medusoids of which remain fixed to the top of the reproductive cells, where they serve as *marsupial* pouches for the development of the ova.

The reproductive cells are developed from the axillæ of the branches, and are at first traversed by a fleshy column, which occupies the axis of the cell, and, being dilated at its summit, closes the orifice. This column differs in no respect from the ordinary alimentary polyp at an early stage of development, and must be considered as a polyp in which development has been arrested, in order to render it subservient to the function of reproduction.

In the female (Plate XXIII., fig. 3) we find a number of sacs developed from the reproductive polyp, each of which consists of,—1st, An ovarian sac formed of two layers, a four-lobed endodermal process or layer (*a*), and an ectodermal layer (*b*), between which are contained one or more ova; and, 2^{dly}, Of an investing capsule, which becomes converted into the umbrella, with lateral canals and tentacles of an imperfect medusoid (*d*), of which the ovarian sac is the peduncle. After the medusoid has issued from the top of the cell, the ova still remain in the peduncle or ovarian sac, but the outer membrane or ectoderm

of the sac presently bursts (*e*), and the ova are discharged into the umbrella of the medusoid (*f*). There they become developed into ciliated larvæ, and are afterwards discharged, to swim away, and, after attaching themselves, become transformed into arborescent zoophytes.

The male capsules (fig. 4, first described by Lister) resemble those of the female, but the medusoid is in a still more rudimentary state. Its tentacles are very short and few in number, the lateral canals are not to be detected (Schultze and myself), and the peduncle and umbrella are imperfectly differentiated.

The reproduction in this zoophyte has been already described by Lister, Loven, and Schultze, but the anatomy of the different parts has not been well distinguished. I have brought this subject before the Society to point out the distinction between the ovarian sac and the other parts of the medusoid, organs which have been lately confounded together by Professor Allman in his papers on the Reproduction of Zoophytes, and as to the homology of which he appears to me to have arrived at inaccurate conclusions. Wherever the medusoid form of generation exists, the umbrella, with its canals, will always be found not homologous with, but superadded parts to, the ovary ; which last, when single, as in the present instance, represents the peduncle of the medusa. Where several ovaries exist, as I have shown in *Campanularia Johnstoni*, and shall show in *Laomedea geniculata*, these organs are developed from the lateral canals, distinct both from peduncle and umbrella, or as bands between the tissues of the peduncle.

The umbrella of a completely developed gymnophthalmatous medusoid, with its canals, is the homologue of the swimming organ of the Siphonophora. The Siphonophora are compound medusæ of the gymnophthalmatous type, in which an aggregation of peduncles (alimentary polyps), tentacles with their bulbs (tentacular polyps), and reproductive polyps, are joined together by a tubular polypary, the whole being buoyed up, as in *Forskalia Edwardsii* (Kölliker), by a swimming organ composed of numerous conjoined umbrellas, each with four lateral canals. In this animal the umbrellas are altogether segregated from the ovaries. In *Hippopodius Neapolitanus*,

and others, in addition to the common swimming organ, each ovary is associated with a minute rudimentary umbrella, as in fig. 9. In *Diphyes*, again, the ovary (fig. 10), furnished with a large umbrella, a serviceable swimming apparatus, becomes freed from the polypary, and floats away as a locomotive reproductive organ, like the *Hectocotylus* of the Cephalopod. So, also, the fixed false medusoid of *C. dichotoma* is nothing more than an ovary with an umbrella, which last, however, exercises—not the function of a swimming organ, but rather, as does the gelatinous envelop secreted by the ovarian sacs of *Sertularia pumila*, *Laomedea lacerata*, &c. (see p. 113)—that of a marsupium.

We have another instance of an umbrella-shaped sac being employed as a marsupial chamber in the reproductive cell of

Sertularia fallax.

In this zoophyte (as I described to the Society, April 1857) the summit of the ovary puts forth four thick lobes, consisting of endoderm and ectoderm covered by corallum; these are gradually developed (as shown in Plate XXIII., figs. 11, 12, and 13) until they form an umbrella with four or eight canals (as in fig. 14). The ova, after leaving the ovary, are received into the cavity of the umbrella, which, on their attaining a more mature stage, opens at the top, and allows them free exit.

On the Reproductive organs of Laomedea geniculata.

PLATE XXIII.

Fig. 15. Medusoid of *Laomedea geniculata*—*a*, ovaries.

On a former occasion I described the existence of ovaries and ova in the lateral canals of *Campanularia Johnstoni*, and the production of the young zoophytes. On examining, in like manner, the medusoids of *L. geniculata*, immediately after their exit from the capsule, I discovered their ovaries with the contained ova. In some of the medusoids the ovaries were situated in close proximity to the peduncle, in others, midway between the peduncle and the marginal canal (as at fig. 15).

*Laomedea lacerata.**Description of Plate XXIV.*

- Fig. 1. Male polypary, with polyps and sperm-cells—*a*, unripe sperm sac—*b*, ripe do.
2. Unripe ovarian cell—*a*, reproductive polyp—*b*, sac inclosing ovary—*c* endoderm of ovary—*d*, ectoderm of do.
3. Ripe ovarian cell, ovary emerging from top of cell and enveloped in gelatinous marsupium.

This zoophyte was described by Johnston ("British Zoophytes," 2d edition), under the title of *Campanularia lacerata*, as having "cells on short stalks, ovato-conical, the upper half cleft in six lanceolate segments," the cells arising from a creeping tube. In August 1852 ("Annals of Nat. Hist."), the Rev. T. Hincks removed it from the genus *Campanularia* to that of *Laomedea*, and described it as follows:—"Stem filiform, ringed throughout; cells on short pedicles, ovato-conical, the upper portion divided into a number of deep convergent segments." He stated that the stems, which did not exceed the *sixteenth of an inch* in height, rose from a creeping fibre, and bore their cells on pedicles composed of four or five rings, somewhat irregularly disposed. And further, that this *Laomedea*, *in its young state*, was identical with *C. lacerata* of Johnston. He had not observed its mode of reproduction. Mr Hincks' description, also, is taken from an immature state of the zoophyte. *L. lacerata* may be found in profusion at Morrison's Haven, Firth of Forth. It attains a height of an inch and a quarter, slender and lax, but is generally about half an inch high, and bushy. Both varieties are covered with ovarian or spermatic cells in the spring. Plate XXIV., fig. 1, exhibits a male specimen taken with the Camera lucida. The polyps resemble in shape those of *C. syringa*, have fourteen to sixteen alternating tentacles, and are capable of extending themselves to more than twice the length of the cell.

The reproductive cells are ovate, and are shortly pedicled, like the alimentary polyp cells, of which I consider them an *in-development-arrested* form. Each reproductive cell grows in close proximity to a polyp cell.

The female cell (fig. 2.) consists of a reproductive polyp (*a*),





from the side of which buds a single ovarian sac inclosed within a layer of the ectoderm (*b*) of the polyp. The endoderm of the ovary (*c*) is branched or lobed, and is moulded, as it were, on and between the ova which lie between it and the ectoderm of the ovary (*d*). As development proceeds, the ovarian sac (its endodermic lobes having been previously absorbed) rises up to, and issues from, the top of the cell (fig. 3), and becomes surrounded by a thick gelatinous mass, secreted from the surface of the ectoderm. The ectoderm of the ovary now bursts, leaving the ova in the gelatinous *marsupium*, where, as in *Sertularia pumila*, &c., they become developed into ciliated larvæ.

The male cell resembles the female cell. Instead of an ovary, a spermatic sac buds from the reproductive polyp. At first a transparent gelatinous plasma is secreted between the branched endoderm and the ectoderm, as at (*a*) fig. 1. In this plasma the spermatic cells, and subsequently spermatozoa, are developed. Meantime, the sperm-sac rises to the top of the cell, is extruded (*b*), and bursts.

IV. (1.) *A few remarks on Lamellaria tentaculata, and its Nidification, &c., as observed at Wick.* By CHARLES W. PEACH, Esq.

In March 1854 I met with *Lamellaria tentaculata* in some abundance, under stones at the back of the South pier of the harbour of Wick. I had seen one or two there before. On finding them so plentiful, I guessed their errand, and set myself to observe their movements, and succeeded in obtaining the clue, more especially after I had kept some in a vase in my house for some time,—they were in-shore for nidification; with these I found that the rocks were covered with patches of glairy jelly-like matter, which I thought had been deposited by the *Lamellaria*; in a week or two a great change had taken place in it, both in colour and consistence, and I saw that it was filled with dark spots, after careful examination it proved to be *Leptoclinum punctatum*, of Forbes and Hanley's "British Mollusca," vol. i., page 18. My reason for suspecting that it belonged to the *Lamellaria* arose from the latter being so much on this matter. I have been thus particular in referring to the *Leptoclinum*, for it will be seen

further on that it plays a conspicuous part connected with the history under notice.

Although the animals and shells of *Lamellaria* are particularly described and figured (in the valuable work quoted) in vol. iii., page 358, and in Plates XCIX, and P.P.—there is no notice of the nests, or in-shore movements,—its habitat is stated to be “the Laminarian zone, and belt of Nullipore.” Its range, though wide, it is said to be rather rare; and although the other species, *L. perspicua*, has been found in Kirkwall harbour, and Eday Bay in Orkney, the *L. Tentaculata*, before my discovery, had only been found as far as Cullercoats, by Mr Alder; indeed, both species are said to be not common.

Like many denizens of the sea (for instance the *Nudibranchiæ*), this beautiful creature, impelled by the promptings of nature, leaves its deeper home to seek a temporary residence nearer the shore, where itself and nidus will be left uncovered at every ebb, and thus an opportunity is afforded to the naturalist to learn something of its history, which, had it not been for this migration, he would have been unable to get at. I soon found that the *Leptoclinum* was selected by the *Lamellaria*, and into it nice round holes were burrowed, where they built their nests and deposited their eggs, in bright yellow rounded masses. The nests were soon covered by the rapid growth of the *Leptoclinum*, which, being transparent, the nests and its contents could be plainly seen through. The bright yellow of the nest (or rather the contents) soon fades and becomes dirty white; the operculum of the nest becomes raised, and being flexible, swells and stands above the surface of the *Leptoclinum*; it is then soon fit for transferring from the rock to the house for examination under the microscope; if far enough advanced, a slice of the embedded nest may be placed in a watch-glass, with enough sea water to cover it, and then over this I lay a thin piece of glass,—the young may be seen moving about in their nursery, and although in such close confinement, from their restlessness it is difficult to catch their forms; after a time they become languid, and then their shape may be seen. The head is trefoil-shaped and furnished with delicate cilia on the

three rounded parts, currents of water are caused by the rapid motion of these appendages; I was however fortunate enough to see them rest from their sports. In the body of the embryo granules may be seen moving about when the creature is active. Probably four or five weeks elapse from the depositing of the ova to the release of the young; this I mention with great caution, as at all times there is difficulty here, caused by weather and other things. I have known them in-shore in the early part of February, and found a few as late as Midsummer. Thus far have I traced them; beyond I could never get with all my care; for the *Leptoclinum* soon becomes putrid, and then farewell to my young broods. It was only by watching for the ripest ova that I got so far as I did. I drew very many blanks to one prize. I never saw the young alive above twice, and then only in the nest, although I have watched them from 1854 to 1858. This year I have done literally nothing, but hope to see before long, should we be favoured with more genial weather than of late. From their pairing, both in confinement and in the sea, I observe that one is always considerably larger than the other. I therefore think that the sexes are separate; the lady is the largest, much more beautifully marked, and decked in brighter array,—no doubt to render her more attractive in the eyes of her more sober clad and diminutive lord. Probably this difference in size, colour, &c., will account for the two species which are said to inhabit our shores; and after all, they may prove to be only one. I do not think the difference in the shape of the shells can be altogether depended on as a safe guide, for I have obtained all the forms figured in the "British Mollusca," from specimens gathered the same day, and within a few feet of each other. On this head I will not insist. Before I came here I never met with them in such numbers. I have, however, now collected them at Land's End and at John o'Groats.

As there appears to be obscurity connected with the history of this interesting portion of our Mollusca, I send this as my mite towards clearing away some of the mist; and as I have attended to fish and mollusca nests more than those of birds, I tell where they are to be found, that you may go a-hunting for yourselves. Should I be so fortunate as to do ever so little

that will be beneficial towards clearing up doubts, I shall be well rewarded.

Supplement to the paper of the Lamellaria tentaculata of the 14th April 1858.

I am delighted that I did not send away the paper on *Lamellaria* last night. I took a second thought, and about 11-30 p.m., out microscope, got the nidi and examined them in water as hitherto, I clearly saw the cilia at play. I then with a pair of sharp scissors, cut the nidus into two pieces, removed one part, and then gently squeezed out the young from the other, added a little water, laid a piece of glass over all, and then had the delight of seeing the "little strangers" better than I ever did before; they are enclosed in a beautiful nautilus-shaped shell, and this envelope is perfectly transparent. These beautiful objects remind me of the young of the Nudibranchiate animals, and the *Aplysia*, &c.

Having now got a step farther in knowing how to handle these beauties, I must try to get farther.

[Mr James Macdonald, Academy, Elgin, has since informed Dr Smith that the *L. tentaculata* is also found in considerable abundance in that neighbourhood.]

(2.) *A notice of Natural Printing of Sea-weeds on the Rocks in the vicinity of Stromness, Orkney.* (A specimen was exhibited.) By CHARLES W. PEACH, Esq., Wick.

In these days of photography, lithography, nature printing, photo-lithography, &c. &c., we feel almost inclined to ask,— What next? I therefore beg to lay before the Society the most interesting fact of *true nature printing* of sea-weeds, which I fell in with in August 1856, immediately below the ruins of the ancient Episcopal palace of Stromness.

I was examining on the sea-shore the charnel-house in which lie the skeletons of the ancient denizens of the waters of the Lower Old Red Sandstone period; my attention was engrossed by their numbers,—the variety and the beauty of the sculpture of the black shining wings and dermal covering of the *Pterichthys*; the "berry-upon bone" cuirass of the *Coccos-teus*; the fluted spears and delicately fretted mail of the *Diplacanthus*; and the burnished and spotted scales of the

Dipterus, Diplopterus, and Osteolepis ; and then the gigantic "nail-bone" of the Asterolepis,—all unmistakeable "foot-prints of the Creator;" these, with the scaly Lepidodendron, and other land-plants,* all causing me to look back on the past Eons. Willing as I might be to muse, and to ask myself questions, I was not long able to do so ; for, in my movements, I came upon rocks of a different character and hue, on which were portrayed pictures of recent plants well known to me. I might have drawn on my imagination, and fancied that some one well skilled in drawing, and willing not to be idle, having found a stretch of flattened rocks prepared for the purpose, had traced with no "'prentice han'," some of the algae of our shores, with a light yellowish colour on the dark ground, and had succeeded so well, that at once I was able to name the genera and species quite as readily as if the plant itself had been displayed on paper, and presented to me for examination by one of the lady algologists who reside in Pomona, and who have, by their persevering and laudable industry, earned the good wishes of all naturalists, by having added so largely to our knowledge of the beautiful "sea-flowers" which had blushed so long unseen on these rich and interesting shores. Now no longer unseen, of which I had ample evidence in the splendid collections so kindly shown to me by several of the lady collectors. I greatly regretted that my legitimate work (the looking after the fossil land-plants) would not permit me to examine them so carefully as I could have wished ; for amongst them I saw many species which hitherto I had only seen on the southern shores of England. To return to the pictures :—I found that they covered large spaces, some of them three feet in length by one-half as much in breadth, and between the tide-marks, from one-half to one-third from low water. *Desmarestia ligulata* was the predominant form, with *Desmarestia* (formerly *Dichloria*) *viridis*. I noticed that *D. ligulata* appeared to be plentiful. A great quantity of it was lying on the rocks, in various stages of decay, no doubt making more pictures where it rested. The form on the slab sent with this, compared with

* See No. 53, Quarterly Journal of the Geological Society, February 1, 1858, page 72, plate V. This I got this day, 16th April 1858.

the specimen spread on paper, will show that there is no mistaking the die used for the "medal." On the same slab, at the paper point, *Dichotria viridis* will be found pretty well defined. After detaching this slab, and one or two smaller pieces, my time was up, and I could examine no farther. The stone herewith sent (such is the case with many of the printed slabs) is coated by *Ralfsia verrucosa*,—a leather-like alga common on our shores. This coating may be likened to the chemical preparation in photography, the Ralfsia being the sensitive part to be eaten away under the influence of the sun, by its overlying, decomposing, and corroding brother. Thus the impress is made; and the stone, when washed by the next flowing tide, will lose all the vegetable matter, both of the decaying Desmarestia and the dissolved Ralfsia,—it being carried away. The picture then shows beautifully on the light ground of the yellow-coated slab. Not only does the Desmarestia destroy the Ralfsia, it also dissolves some of the rock; and thus, as well as the depression left by the washed-out alga, it is also engraved in the stone; and probably this depression is farther carried on from time to time by the carbonic acid in the sea-water; and thus the more indelible it becomes. Even in rocks of a deep, dark gray colour, containing little or no lime, and on which no growing alga is to be seen, the Desmarestia imprints its form, by extracting the colour; and, although not so distinct as the prepared one, it is often well defined. I saw some such on the coast. The lady of the Rev. Mr Learmonth kindly showed me one, which a quarryman had taken years before as a plant of the age of the Old Red Sandstone. It retained all its markings quite fresh. The rocks dip gently to the westward, and are exposed to the full sweep and terrific lash of the waves of the Atlantic. The first, and I may say the only impress, must be quickly done, to use a printer's term, "at one pull;" for each returning tide would certainly remove the weed, and leave not a trace of the vegetable matter behind. When we take into consideration the well-known property of destroying other algæ possessed by the Sporochneæ, to which both the imprinted plants belong, we cease to wonder at the eating away of the Ralfsia. The extraction of the colour and dissolving the hard

rock will, however, cause some surprise ; and we naturally ask what can this lithographing property be ? This and many other questions must be passed, and the uppermost thought attended to ; for we are looking back upon the ancient periods in the history of our earth. I have found in most of our rock formations plant-like forms "painted," or rather "discharged" out. When cleaving the Devonian and Silurian rocks of Cornwall, and the Old Red Sandstones of Caithness and Orkney, they have often occurred, and I have been struck by their forms ; for so like plants have they appeared, that again and again I have found great difficulty in persuading myself that they were not plants, always pleading the absence of organic matter. This was a sad stumbling-block, for not a vestige could be seen. Others have been equally perplexed. Our lamented friend, Mr Hugh Miller, after speaking of the now acknowledged land-plants of the Lower Old Red Sandstone of Caithness, &c., says, at page 435, "Testimony of the Rocks,"—"I may here mention, that curious markings, which have been regarded as impressions made by vegetables that had themselves disappeared, have been detected during the last twelvemonth in a quarry of the Lower Old Red Sandstone near Huntly, by the Rev. Mr Mackay of Rhynie. They are very curious and puzzling ; but, though some specimens present the appearance of a continuous midrib, that throws off, with a certain degree of regularity, apparent leaflets, I am inclined to regard them rather as lying within the province of the ichnologist than of the fossil botanist."

From never having seen any of my friend the Rev. Mr Mackay's "puzzling specimens," I am unable to give a decided opinion about them ; but from the tenor of the passage (of which I have only quoted a part) I should be inclined to give them to the botanist. The absence of "vegetable" matter, with the "mid-rib" and "hard fern"-like appearance, weigh greatly with me now ; for, as with the fossil, so with the beautiful recent Stromness forms—no portion of the vegetable can now be seen. There is plenty of proof that the Stromness pictures now presented to your notice were made by plants. I tried, on my return home, the experiment of laying a piece of *Desmarestia* on a stone from the beach, and exposed it in

the hot sun, and kept it damp with sea-water; and, although the plant was far gone in decay, and the stone "not prepared," as well as too pale and siliceous, a faint impress was made, distinct enough to show that with better materials success would be certain. I have since ascertained that one of the fair algologists of Pomona was long ago aware of these markings, and, with the splendid materials there, had fully succeeded in getting them delineated in the way that I tried.

• We know that, as well as land-plants, sea-plants also existed in the Lower Old Red periods; plants, principally of the sea, were in the Silurian times; and, as tides ebbed and flowed then, and the sun shone as now, why might not the *algæ* be cast on their exposed and ripple-marked rocks, and their likeness imprinted through a *Ralfsia* by the ancient *Desmarestias*, and that, too, indelibly, before the next flowing tide swept away the type, and left no trace of organic matter behind? I wish it most distinctly to be understood, that I do not insist on claiming all dendritical markings on and in rocks for the botanist; for I know that some of the doubtful markings are caused by infiltration,—very many by the sportive arborescent forms of minerals. Add to these the markings from the crawling of Crustacea, the wriggling of the Annelides, and the tracks of the vegetable feeding Mollusca, all playing their part in the puzzling drama. I could enumerate very many things of this kind,—one observed on last New Year's Day, when I saw the animal at work painting. I must, however, after acknowledging all this, and after striking the balance, still think there is a probability that the printing process had thrown off the greatest number. I have delayed sending this to you, in the hope of finding some notice of a like process beyond the very short one I sent to the meeting of the British Association for the Advancement of Science at the time of the discovery, but have never been able to find a word. I therefore now venture to trouble you, in the hope that it will become more widely known, and the means of showing that it is going on in different parts of the globe.

[Mr Alexander Bryson remarked, that this was indeed the first example of Natural Photography which had been recorded;

and congratulated their energetic member, Mr Peach, on his discovery. As an amateur in Photography, he was not at a loss to account for the effects produced; the Desmarestia furnished the iodine, and the sea itself was capable of supplying all the silver required for the process, while the sun, though it did not stay in its course, yet "played the alchemist."

V. Dr J. A. SMITH exhibited a male specimen of the *Raia spinosa*, the Sandy Ray of Cornwall, where it was first observed by Mr Couch. It had also been taken off the coast of Ireland, as mentioned by Mr Yarrell, who figures it in the second volume of his "British fishes." The fish on the table measured 2 feet in length to the point of the tail, and 1 foot 2½ inches broad; and, as far as he was aware, it was the first time it had been observed on the Scottish coasts. Its preservation showed the interest excited among his acquaintances by the labours of one active naturalist, as the fish was observed at Boathaven, near Wick, by R. Boyd, Esq., Collector of Her Majesty's Customs, Wick, on the 23d ult., who immediately secured it as possibly something to interest his friend and colleague Mr Peach; and the latter gentleman discovering its rarity, kindly forwarded it for exhibition to the Society.

[Dr Smith has since been informed by Mr James Macdonald, Elgin, that the *R. spinosa* had been several times taken on the adjoining coast of Morayshire.]

Dr Smith placed on the table a specimen of the *Gasterosteus spinachia*, the fifteen-spined stickleback, taken at Portobello in March last. Dr Parnell considered it rare in the Firth of Forth.

VI. *Notice of Granite found in situ in Mid-Lothian.*

Mr George Forrest, 96 Nicolson Street, exhibited specimens of a compact grey granite, in colour much like that found at Aberdeen, which had been lately discovered *in situ* near Esperston. Mr W. A. Jardine, C.E., had visited the place, and it appeared to exist in considerable quantities. He made some remarks as to the importance of the discovery in an economical point of view, and at so short distance from the city.

[Dr Smith had since learned a few additional particulars of the discovery, which he considered of some little interest.

Mr W. A. Jardine, C.E., the engineer to the Edinburgh Paving Board, had been for some time back making a collection of specimens of rocks; and among those sent him from the parish of Heriot, was a portion of this rock from near Esperston, which he gave to Mr Forrest for examination, and which was evidently grey granite. Mr Jardine and Mr Forrest brought the matter under the consideration of the Paving Board, and a deputation, including these gentlemen, visited the locality. It appeared that Mr Pringle, Garvald, in excavating for materials to build stone dykes, had recently exposed the rock near Carcant Nick, on the road from Fushie Bridge to Innerleithen, where it seems to form the principal part of the hill of Broadlaw, stated in the Ordnance Survey map as 1414 feet in height; the strata, described as of grey-wacke, being exposed on its side in nearly a vertical position. Dr Smith observed what appeared to be small particles of the *White Iron Pyrites* disseminated through one of the specimens of this granite. Should this occur generally, from the well-known easily decomposing property of this Pyrites under the action of the weather, he feared the beauty, if not the durability, of this granite might possibly be affected.]

VII. *Notes of some Experiments recently made on the Preservation of certain Marine Radiata.* (Numerous preserved specimens were exhibited.) By JAMES B. DAVIES, Esq., Assistant Conservator, University Museum.

Though the experiments, the results of which I am about partially to lay before you, were commenced fully two years ago, they are yet so far from being completed, that I can only plead as my excuse for calling your attention to them just now, the fact that they may be of some service to a few of you during the recess, and may perhaps secure me the co-operation of such of the members of the Royal Physical Society as devote themselves to Marine Zoology.

At present I desire to restrict myself to the Sub-kingdom RADIATA, not on account of any peculiar regard for that group, but simply because many of the members of it are so imperfectly represented in Museums, public as well as private, on account of the difficulty of preserving the specimens with

anything like a natural appearance. I cannot, be it understood, assert that I have yet succeeded in procuring an anti-septic fluid which combines all the properties such a solution should possess,—*i.e.*, to preserve *perfectly*, form, consistency, and colour,—but I believe I am fully justified in stating, that I have been able to make a step in that direction.

My experiments were first made with pure Glycerine, and I found that with it I could preserve the colour of *star-fishes* (as had been already done by others), and also that the smaller *Medusæ* preserved their forms in it. The *Actiniae* were also tolerably preserved, so far as colour was concerned; but with large *Medusæ* it was a total failure. The chief objection to the use of Glycerine is the undue transparency it communicates to zoological specimens; another is the slimy unsubstantial consistence it generally imparts.

There are unfortunately two other barriers to its extensive use,—*i.e.*, the high price it commands, and the difficulty of getting it pure.

I made the attempt to dilute the Glycerine with a fourth, a third, and a half of its bulk of water, and, as a result, lost my specimens.

Acetic Acid, I tried for *Medusæ*, but found that, however diluted with water, the specimens always shrank and became opaque in it.

White Arsenic was equally unsuccessful when used for *star-fishes*, the specimens invariably loosing colour, and ultimately decaying.

Chloride of Zinc and other metallic salts did not give satisfactory results, as they almost invariably caused the specimen to shrivel and assume the consistency of a piece of hard leather.

Goadby's solution for *Medusæ* (in Forbes' "Medusæ," Vol. of Ray Society) I found to answer very well, but with the great objection, that it finds so many ways of exit from the preparation jar, and crystallizes so quickly, that a moderately sized collection put up in that fluid would require to have a man towel-in-hand, watching it from morning till night.

The fluid I would propose for the preservation of *Medusæ*, while it is free from this objection, preserves, I think, the

general appearance of the specimen fully better than Mr Goadby's. It is simply methylated spirit reduced to from 30 to 40 under proof, with creosote added in the proportion of 40 to 50 drops to the quart.

VIII. *Notice regarding the Food of Patella vulgata, &c.* By JOHN ALEX. STEWART, Esq., Lochcarron. Communicated by ANDREW MURRAY, Esq.

The object of this paper was to show that the *Patellæ* were not purely phytophagous, but also carnivorous. In support of this view Mr Stewart narrated some observations made by him, when he had seen the *Patella vulgata* rasping away at the young *Balani* with which the rocks were covered, and he sent for exhibition to the Society the contents of the stomach of *P. athletica* and *P. vulgata*, taken near Lochcarron, in the north-west of Scotland. Among the contents of the stomach of *P. vulgata*, were fragments of the shells of young *Balani*; on the other hand those of *P. athletica* seemed almost entirely composed of *Corallina officinalis*.

Mr Stewart's paper also contained some interesting details as to the *Patellæ* returning habitually to rest on the same identical spot, so as to leave its impress quite distinct, while all the rock around was overgrown with *Balani*, &c.

IX. *Dumfriesshire Graptolites, with Descriptions of three New Species.*
(A collection of these fossils were exhibited.) By WILLIAM CARRUTHERS, Esq.

At the meeting of the British Association held at Edinburgh in July 1850, Professor M'Coy read a list of the then known Graptolites of the south of Scotland. They amounted to fourteen species. My examination of the graptolitic shales has been chiefly confined to those which occur in Dumfriesshire. In this district the following Graptolites, amounting to twenty-four species, have been found:—

Rastrites peregrinus, Barr. Bran Burn, Dobb's Linn.
triangulatus, Hark.

This is a remarkably abundant fossil at Garple Linn. Having examined a large number of specimens from this locality, and been unable to discover anything approaching the form *G. Sedgwickii*, I am satisfied that this is a distinct species, and have consequently inserted it in this list.

Graptolites sagittarius, *Lam.* Lockerbie.
 tenuis, *Portl.* Lockerbie, Dobb's Linn.
 convolutus, *His.* Lockerbie.
Sedgwickii, *Portl.* Duff Kinnel, Dobb's Linn.
 millipeda, *M'Coy.* Lockerbie.
 lobiferus, *M'Coy.* Lockerbie.
Nilssonii, *Barr.* Bran Burn, Garple.
Nicoli, *Harkn.* Beld Craig, Glen Kiln.
Becki, *Barr.* Beld Craig.
Cladograpsus linearis, nov. sp. Hartfell.
Diplograpsus rectangularis, *M'Coy.* Dobb's Linn, Hartfell, Lockerbie.
 foliaceus, *Murch.* Hartfell, Dobb's Linn.
 folium, *His.* Dobb's Linn, Bran Burn, Hartfell.
 mucronatus, *Hall.* Hartfell.
 nodosus, *Harkn.* Bran Burn.
 pennatus, *Harkn.* Duff Kinnel.
 teretiusculus, *Harkn.* Glen Kiln.
 bicornis, *Hall.* Hartfell.
 tricornis, nov. sp. Hartfell.
Didymograpsus sextans, *Hall.* Hartfell.
 ramosus, *Hall.* Hartfell.
Moffatensis, nov. sp. Hartfell.

Cladograpsus linearis.

Fragments of this fossil are frequently mingled with the *Diplograpsus foliaceus* at Hartfell. It may have been before noticed, and probably referred to some known species as a variety. Having obtained in this locality a number of specimens in a thin bed, where it occurred in great abundance, and almost alone, I am able to describe it as a distinct species.



From a short and very slender base the zoophyte divides into two stems, each supporting the cells on their upper sides.

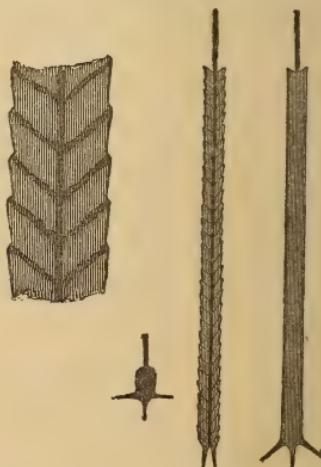
Branches are given off at irregular distances from these principal stems. The length of the polypidom has been very great; one specimen I have been able to trace for nearly three feet. The polypidom has been formed of a flexible substance; for they are seldom found in straight lines, but generally in curves, or bent, without breaking, on themselves. The appearance of this zoophyte in its living state—its long graceful stem yielding to the motion of the water, and its crown of tentacles occupying every cell, which were sufficiently removed to exhibit their individuality—must have been very beautiful.

The polypidom at its origin, near to the slender base, is very narrow, being little more than a fine line; as it increases in length it increases in breadth, until it is fully two-fifths of a line broad. The cells are very remote from each other, and are, at first sight, from the slight indentation they make in the stem, scarcely perceptible, giving the graptolite the appearance as if it were a clear line. The mouth of the cell is straight, and at right angles to the axis; it makes an indentation equal to about one-sixth of the breadth of the polypidom. The number of cells in an inch is about eighteen.

Diplograpsus tricornis.

This species can be readily distinguished by the three spines which adorn its base, and which are almost always preserved. The central spine is a continuation of the line of the axis; it is shorter than the lateral ones. They generally form a more or less acute angle with it, and are never farther removed than to form a right angle; occasionally they assume a graceful curve. The polypidom is more slender than in *D. foliaceus*, which in general outline it somewhat resembles. The axis is slender, and produced beyond the other parts of the fossil.

The cell-walls are well marked, extending upwards from the

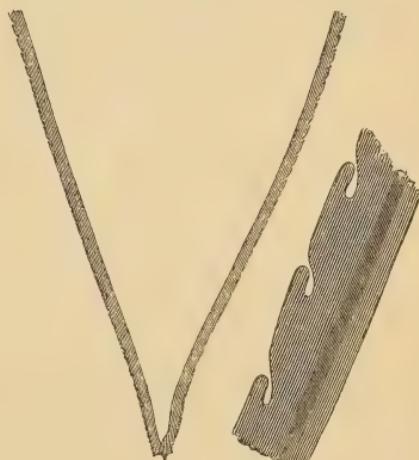


axis to the boundary of the fossil. Each cell forms a rhomb whose outer border is slightly indented, giving the boundary of the fossil a faintly serrated aspect. When the fossil is preserved so as to show the serratures, the spines are so compressed that the central one is almost or altogether lost. When the spines are well preserved, and in the position described, no traces of the individual cells are discoverable: the boundary of the fossil is an unbroken line.*

This species is abundant in a thin bed at Hartfell.

Didymograpsus Moffatensis.

This is the most elegant of the British species of this genus. The base terminates in three distinct spinous processes. The zoophyte bifurcates from the base. The general appearance is like the figure; or occasionally the lines form an acute angle for about a quarter of an inch, then suddenly expanding in slight curves, almost at right angles, for a short distance, when it again recurs to its original direction. The branches are united for about a quarter of a line by a slight web, which in some specimens is terminated in a fine process of short length, taking the direction of a line bisecting the angle. The cells are arranged on the outer margins; they are very remote, and penetrate the polypidom to scarcely one-fourth of its breadth; they form slight openings on the margin of the polypidom, first entering at a right angle, and then suddenly turning downwards. These openings are lengthened ovate pouches, answering exactly in shape and size to the cell-serratures of the margin. The number of cells in an inch is about



* The length of the polypidom is more variable in this Graptolite than in any other I have gathered. A young form, as represented in the figure, is not uncommon.

twenty. The breadth of the polypidom is about two-thirds of a line.

This species is found in the shales at Hartfell.

The specific name is derived from the locality where it is found, which is in the neighbourhood of Moffat.

X. Mr JOHN LIVINGSTONE exhibited a fine specimen of the *Poterioceras ventricosum* of McCoy, which was obtained by him in August 1854, from the carboniferous limestone beds quarried at Turniedykes, near Gorebridge. He considered it to be the first instance of this fossil having been noticed in Scotland.

Thanks were voted to the Office-Bearers, and the Society adjourned to November 1858.

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ERRATA.

Page 14, line 15, for 1853 read 1855.

- 5, line 12, for Hardinger read Haedinger.
- 191, line 3 from foot, for Presmennan read Penmanshiel.
- 259, line 38, for *Thera variata* read *simulata* Hub. (Coniferata, *Curtis*).
- 259, line 42, for *simulata* read *variata*.
- 432, line 21, for *Larnyx* read *Larynx*.
- 432, line 24, and p. 433, line 8, for *artica* read *arctica*.
- 334, *foot-note*, for number read volume.
- 408, line 11, for *Thera simulata* read *T. variata*.
- 408, line 33, for *Gelechia instabilis* read *G. instabilella*.
- 411, line 28, for *Omara* read *Amara*.

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